BULLETIN

OF THE

AMERICAN GEOGRAPHICAL SOCIETY.

Vol. XXXI 1899. No. 2

PHYSICAL GEOGRAPHY OF NEW YORK STATE.

BY

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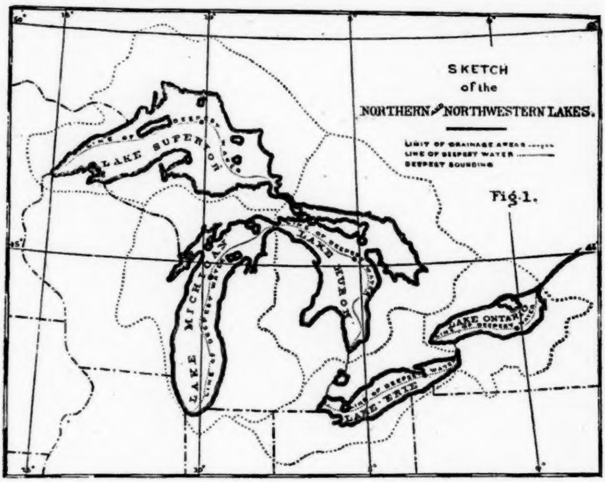
PART VII.—THE GREAT LAKES AND NIAGARA.

THE GREAT LAKES.

DESCRIPTION OF THE ST. LAWRENCE SYSTEM.*—The St. Lawrence is quite unique among the river systems of the world. At its mouth the river and its tributaries are drowned, so that the salt water of the ocean enters to form the broad Bay of St. Lawrence, with its irregular margin. Even further out than this, there is indication of a river valley carved in the continental shelf and completely covered by the ocean. From the Bay of St. Lawrence up stream the water area narrows and the water freshens, though the tide rises nearly as far as Montreal, at which place the St. Lawrence is a very broad river, with gentle current. Just above this place, the river changes in habit, becoming a series of violent rapids, and from this point up stream there are frequent stretches of quiet water, separated by rapids. Then, at the outlet of Lake Ontario, the river passes through a maze of islands, beyond which is Lake Ontario itself, one of the five Great Lakes, which, because of their immense size and close connection, constitute one of the remarkable features of the system.

*Schermerhorn, Amer. Journ. Sci., 1887, CXXXIII, 278–284; Vedel, Amer. Geol., 1896, XVIII, 196; Bigsby, Phil. Mag., 1829, 2nd Ser., V, 1–15; 81–87; 263–274; 339–347; 424–431; Henry, Trans. Albany Inst., 1830, I, 87–112.

These several lakes are connected by broad rivers and straits, which, in places navigable, are elsewhere interrupted by rapids, and in one case by the greatest fall in the world, Niagara. The water area above the Thousand Islands outlet of Lake Ontario, including the lakes and connecting streams, is about 95,275 square miles;* but to this entire area there is no large river tributary. As will be



SCHERMERHORN'S SKETCH MAP OF THE GREAT LAKES.

seen by the map (Fig. 1), the divide of the system sometimes runs close to the lakes, and is never very far from them. The total area of the Great Lake system is about 270,000 square miles, of which, as has been said, about 95,275 square miles is water. This of itself is a remarkable feature, and will be referred to later as having an important bearing on the history of the St. Lawrence system.

"The water surface of Lake Superior nearly equals the combined areas of New Hampshire, Vermont, Massachusetts and Connecticut"; and the "combined area of the lakes exceeds the area of England, Wales and Scotland"; while "the length of shore line of the lakes and their connecting rivers is about 5,400 miles, or about equal to the coast line from Maine to the isthmus of Panama," ignoring minor indentations.†

* Most of the figures and facts in this section are taken from Schermerhorn's valuable paper, Amer. Journ. Sci., 1887, CXXXIII, 278–284.

† Schermerhorn, Amer. Journ. Sci., 1887, CXXXIII, 279.

	Length, miles.	Average width, miles.	Maximum width, miles.	Shore line, miles.	Water area (including islands), square miles.	Average depth, feet.	Maximum depth sounded, feet.	Surface above tidewater, feet.	Deepest point above tidewater, feet.	Water volume, cubic miles.	Land area of water shed, square miles.	Aggregate water and land area of water shed, square miles.
Lake Superior	390	70	160	1,300	31,200	475	1,008	602	−406	2,800	51,600	82,800
St. Mary's River	53 40	2½ 2	5 4	100	200	..	53	..	..	..	800	1,000
Lake Michigan	335	58	85	875	20,200	335	870	581	−289	1,290		
Green Bay	115	15	21	260	1,700	95	144	581	+437	30	37,700	60,100
Mackinac Strait	30	16	23	60	500	75	234	581	+347	7		
North Channel	110	12	18	220	1,400	70	240	581	+341	20		
Lake Huron	250	54	100	725	17,400	210	702	581	−121	650	31,700	55,700
Georgian Bay	120	40	58	390	5,200	170	462	581	+119	170		
St. Clair River	35	1	..	70	30	..	..	..	..	..	3,800	3,830
Lake St. Clair	19	25	29	90	410	..	21	575	+554	1	3,400	3,810
Detroit River	27	2	3½	54	60	..	..	..	..	..	1,200	1,260
Lake Erie	25	40	58	590	10,000	70	204	573	+369	130	22,700	32,700
Niagara River	34	1	2	70	60	..	..	..	..	..	300	360
Lake Ontario	180	40	58	600	7,300	300	738	247	−491	410	21,600	28,900
St. Lawrence River	760	20	95	..	..	..	..	..	..	..	..	..
Totals	.....	.....	.....	5,404	95,660	.....	.....	.....	.....	5,508	174,800	270,460

Table copied from American Geologist (by Vedel), 1896, XVIII., p. 196.

From the table it is seen that Lake Superior is 602 feet above sea level, Huron and Michigan 581 feet, the descent between them being chiefly in the rapids of St. Mary's River. There is then a descent of about 8 feet to the level of Erie (573), mostly in Detroit River, while Ontario has an elevation of about 247 feet. Of this descent, 160 feet occurs *at* the Falls, 110 feet in the rapids of the gorge, and 50 feet in the rapids just above the Falls. This leaves only 6 feet of fall for the upper Niagara River above the rapids.

The beds of the lakes, excepting Erie, are below sea level, and so much is below this level that even if their water surface were lowered down to the level of the sea, there would still remain large bodies of water in the sites of Ontario, Michigan and Superior, while Erie would disappear and Huron shrink to small size.

The rainfall of the entire lake area averages about 31 inches, being higher in the eastern than the northwestern end. This rainfall fills the lakes, satisfies percolation and evaporation, and furnishes for discharge 86,000 cubic feet per second from Lake Superior, 225,000 cubic feet from Michigan and Huron, 265,000 cubic feet from Erie through the Niagara, and 300,000 cubic feet per second from Lake Ontario. Its aggregate discharge is double that of the Ohio, nearly half that of the Mississippi, and represents about one-half the rainfall, while in the case of the Ohio and Mississippi the discharge is equal to about one-quarter of the rainfall. The total bulk of water in the system is about 6,000 cubic miles, nearly one-

half of which is in Lake Superior. This amount "would sustain Niagara Falls in its present condition for about 100 *years.*" *

Portions of Lakes Erie and Ontario, the Niagara River, and the upper St. Lawrence itself, lie within the State of New York; and while it is this portion alone which properly concerns us, no adequate discussion of the New York section of the system can be presented without including the entire drainage area. Naturally, the question of the origin and history of this interesting river system has attracted wide attention and has been the subject of much investigation and theorization. As the result, there have been gathered a large number of facts of various kinds, and there have been proposed numerous hypotheses.

It is no small task to weigh these facts and candidly discuss the various hypotheses; but since this has never been done, it seems well to attempt it. Within the limits of this series, it is not possible to do this with completeness, although the attempt is made to so discuss the subject as to consider the salient points. It must be admitted in advance that, in the main, a definite result will not be attained from this discussion; it is too early for final conclusions. But some facts and conclusions will be found to be established, while others may be considered probable. Never having written upon this general subject before, though for several years having had the question in mind, I feel able to approach it without bias, though in discarding as untenable some of the hypotheses that have been proposed, and in arguing against others, I realize that the advocates may not stand ready to accept my conclusions. All I claim for this discussion is that it is based upon a certain familiarity with the region, a careful and extended reading of the more important papers, and a candid consideration of the facts obtained from these two sources.

PREGLACIAL HISTORY.—It is evident that before the glacial period, the country included in this river system, together with other parts of northeastern North America, had for a long time been subjected to denudation. No modern geologist questions this, and the evidence of it may be found on every hand. The result of this exposure to denudation was the transformation of the land into a series of hills and valleys, occupied and drained by rivers. Our *general* land topography has been produced by this long denudation, and no one questions that at least a part of the form and

* Schermerhorn, Amer. Journ. Sci., 1887, CXXXIII, 282.

topography of the valleys of the Great Lakes has resulted from its action.*

FIG. 2.—NEWBERRY'S IDEAL RESTORATION OF THE NEW YORK REGION IN PREGLACIAL TIMES.

Another fact upon which there is probably no difference of opinion, is that, in the period before the general glaciation, the land stood at a higher level than now and that it stood at such a level for a long time. The exact amount of this elevation is unknown; but off the coast of eastern America the depression since that time has been enough to completely submerge the lower ends of some river valleys, while in the region of the present lower St. Lawrence it was enough to drown the main valley and its tributaries, such as the Saguenay. The elevation certainly amounted to many hundreds of feet, and it lasted long enough for rivers to carve deep and broad valleys of mature form, portions of which are now completely obscured from view by a submergence below the ocean water.

Whether the lakes existed before the glacial period, can not be stated positively upon direct evidence, though without doubt most physiographic geologists will agree that they did not. The reasons for this conclusion are, in the first place, that we know of no cause for their existence immediately before the glacial period. Lakes, even the great ones, are not long-lived, as geological time goes, and had they been formed in periods much earlier than this, they would

*Agassiz (Proc. Amer. Soc. Adv. of Sci., 1849, I, 79; Lake Superior, Boston, 1850, 417–426) points out that the detailed outline of part of the shore of Lake Superior is due to the presence of dikes, indicating that denudation has been influenced by them.

have long since been destroyed by filling. In the second place, and more important than the other point, it may be said that, had they existed, there should have been formed extensive lake deposits, containing lake fossils, some evidence of which should have been discovered in the course of the careful study of the lake shores and the drift-covered country south of them. This negative evidence, and the fact that lake basins must have a definite cause, has weight

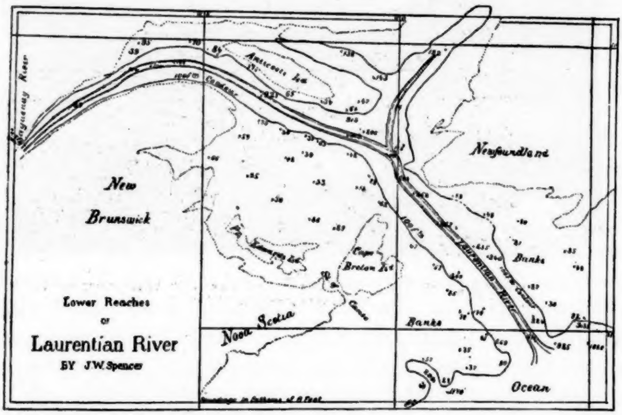


FIG. 3.—SPENCER'S INTERPRETATION OF THE PREGLACIAL COURSE OF THE LOWER ST. LAWRENCE.

of sufficient importance to lead to the conclusion that the Great Lakes probably did not exist in preglacial time.

By what, then, were the present valleys occupied? In considering this, we leave for future discussion the question of the origin of the present *closed* basins and assume the existence of valleys, without raising the question whether they were then as deep as now. Were these valleys occupied by the preglacial St. Lawrence River? This question may be answered positively by the statement that no such river existed along the present line of passage of the St. Lawrence water. Whatever the preglacial drainage may have been, no river that was able to form an upper valley like that of Superior, Huron and Michigan would then change to a Detroit river, or to a Niagara. All would agree that the present course is not *exactly* the preglacial course.

However, when we come to consider how far this preglacial course differed from the present one, we come to a point where diversity of opinion exists. Numerous attempts to reconstruct parts or the whole of the preglacial drainage have been made, and

some investigators have pointed out the existence of buried channels revealed by borings and have shown that they may represent the preglacial courses of some parts of the St. Lawrence system.

For instance, Newberry* notes the existence of buried river valleys, notably the Cuyahoga, which enters the valley of Lake Erie at a depth considerably below the lake surface. This he takes as evidence that the Lake Erie valley was a preglacial valley at a time when the land stood higher. This was the time when the drowned valleys of the coast were formed.

This view is carried a step further in later articles,† where he points out the existence of a buried channel at Detroit 130 feet below the city, and another south of Lake Michigan 230 feet deep. He also shows that Onondaga Lake of New York has beneath it a depth of 414 feet of drift deposit, so that the rock surface here is 50 feet below sea level.‡ The great depth of drift near Syracuse, together with other facts, led Newberry to the conclusion that the preglacial drainage of at least the eastern lakes found outlet through the Mohawk and the Hudson.§ This interpretation is opposed by Carll,‖ and by Lesley,** the latter calling attention to the fact that, according to this view, there must be a channel near Little Falls, New York, with at least 1,000 feet of drift-filling. It is doubtful if any one who is familiar with the Mohawk valley would now hold this view of Newberry's, for there seems to be no opportunity for such a river at this place. At Little Falls the valley is crossed by

* Proc. Boston Soc. Nat. Hist., IX, 1862–63, 42–46. See also later articles by Newberry (referred to on p. 111). Also Winchell, Amer. Journ. Sci., 1871, CII, 15–19; Orton, Geol. Survey Ohio, Vol. I, 1873, 425–434, 438–449, 455–462; Geol. Survey Ohio, Vol. VI, 1888, 772–782; Spencer, Proc. Amer. Phil. Soc., XIX, 1880–81, 300–337, and later articles, see p. 112; Foshay, Amer. Journ. Sci., XL, 1890, 397–403; Leverett, Amer. Journ. Sci., XLII, 1891, 200–212; Hershey, Amer. Geol., 1893, XII, 314–323; Mudge, Amer. Geol., 1893, XII, 284–288; Same, 1894, XIV, 301–308; Same, Amer. Journ. Sci., 1895, L, 442–445; Same, Amer. Journ. Sci., 1897, IV, 383–386; Chamberlin and Leverett, Amer. Journ. Sci., 1894, XLVII, 247–283; Upham, Bull. Geol. Soc. Amer., 1896, VII, 327–348; Same, 1897, VIII, 6–13; Pierce, Amer. Geol., 1897, XX, 176–181.

† Newberry, Geol. Survey Ohio, 1869, 24–31; Annals N. Y. Lyceum Nat. Hist., 1870, IX, 213–234; Amer. Nat., 1870, IV, 193–214.

‡ Newberry first said that the Cuyahoga channel was 100 feet below the lake surface; but later (Geol. Survey Ohio, 1873, I, 175) he shows that the depth is as much as 228 feet. Upham, Bull. Geol. Soc. Amer., 1897, VIII, 6–13, finds the depth of the channel to be 470 feet below lake level.

§ Pop. Sci. Mon., 1878, XIII, 641–660; Proc. Amer. Phil. Soc., 1882–83, XX, 91–95.

‖ Second Geol. Survey Pennsylvania, 1880, Report III, 369.

** Proc. Amer. Phil. Soc., 1882–83, XX, 95–101.

rock, and on either side of this there is no place for the existence of a valley of this depth and of sufficient width to correspond to the depth. Moreover, Brigham* has recently proved very clearly that the region about Little Falls represents a divide, and that the Mohawk is a complex of two streams, one east-flowing, the other west-flowing.

Spencer has also† attempted to reconstruct the pre-glacial drainage of the Great Lakes and has pointed out the existence of numerous buried valleys, notably one apparently connecting Lakes Erie and Ontario, via Hamilton, in Ontario. He has realized the difficulty of proposing an outlet for Ontario, because neither the Mohawk nor the St. Lawrence courses seem adequate, and there is no other place apparent. This difficulty he meets by assuming that the outlet has been closed by the tilting of the land, so that the old valley, which was approximately along the line of the present St. Lawrence, no longer slopes eastward. As will be seen by the map (Fig. 4),

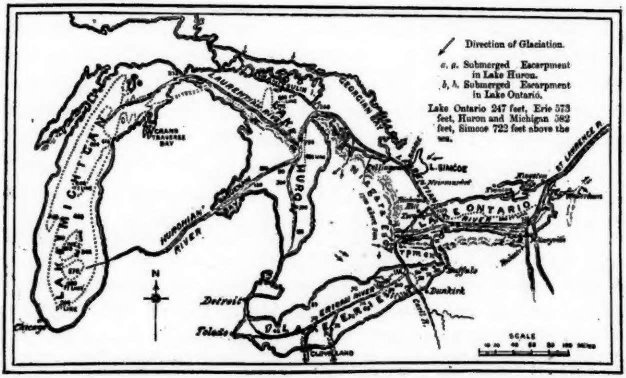


FIG. 4.—SPENCER'S INTERPRETATION OF THE PREGLACIAL COURSE OF THE DRAINAGE OF THE GREAT LAKES REGION.

Spencer locates the sites of these supposed rivers, and gives them names.

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* Bull. Geol. Soc. Amer., 1898, IX, 183–210.

† Proc. Amer. Phil. Soc., 1880–81, XIX, 300–337; Second Geol. Survey Pa., Rept. QQQQ, 1881, 357–406; Proc. Amer. Assoc. Adv. Sci., 1881, XXX, 131–146; Same, 1888, XXXVII, 197–199; Bull. Geol. Soc. Amer., 1889, I, 65–70; Quart. Journ. Geol. Soc., 1890, XLVI, 523–533; Amer. Geol., 1891, VII, 86–97; Pop. Sci. Mon., 1896, XLIX, 157–172; Amer. Geol., 1898, XXI, 110–123. A number of Spencer's papers are republished in the appendix of the 11th Ann. Rept. of the Niagara Reservation Commission, 1895. Some of Spencer's other papers (referred to in the continuation of this article in the next number) refer to this view of the preglacial drainage.

Still another view of the former course of the drainage of the Great Lakes region is that much of the water formerly outflowed to the Gulf of Mexico through the Mississippi River.* Our knowledge of the Canadian region is too limited to permit the assumption that none of the drainage found its way northward in preglacial times.

Thus it is seen that, while we know that there were valleys in preglacial times, there is no consensus of opinion as to their course. On the part of some it has been a common assumption that the buried valleys discovered in borings are all preglacial; but by others it has been suggested that some of them are interglacial. For instance, Newberry† says that the preglacial valleys having been enlarged, were later connected by cañons, and again occupied by ice, and finally by drift. Upham‡ explains the narrow and deep cañon-like buried valleys as a result of the uplift which preceded the glacial period.

From this maze of conflicting opinions it is difficult to determine upon the correct explanation. One point seems fairly clear,—that the *preglacial* valleys were not as deep as the present ones. The lake basins are broad, boat-shaped valleys; but there are no equivalent valleys connecting them. Instead, deep cañons are found in a few places, and these are assumed to represent the connecting rivers. Those who advocate this fail to explain why a broad valley abruptly narrows to a cañon, when there is no noticeable variation in rock structure.

Since there are no broad, connecting valleys, it follows that the present depth of the basins has been caused by some change in conditions, and this conclusion will be discussed later. How much these have been deepened is not now apparent; but from all the facts that we have, there are none which would disprove the view that the old valley bottoms might have been as high as the level of the present lake surface. With so much uncertainty, it is evident that it is difficult to trace the preglacial course of the rivers involved in the carving of the valleys.

The buried gorges connecting the basins may be due to immediately preglacial uplift, as suggested by Upham,§ or they may be

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* See, for instance, Russell, Lakes of North America, Boston, 1897, p. 97; Upham, Amer. Geol., 1896, XVIII, 169–177, and Upham, Bull. Geol. Soc. Amer., 1897, VIII, 6–13.

† Proc. Amer. Phil. Soc., 1882–83, XX, 91–95. See also Hershey, Amer. Geol., 1893, XII, 314–323.

‡ Bull. Geol. Soc. Amer., 1897, VIII, 6–13.

§ Bull. Geol. Soc. Amer., 1897, VIII, 6–13.

interglacial gorges. They are certainly younger in form, and hence in age, than the preglacial valleys with which they are associated; and while they *may* mark the approximate course of the preglacial rivers, they may, on the other hand, represent a course far divergent from the original preglacial one. So it seems that any argument in favor of preglacial courses which is based upon evidence obtained from the drift-filled cañons is not necessarily valid.

My own belief is, that the present Great Lake system is a complex made by the union of portions of several streams as the result of various accidents, particularly the glacial accident. There may be portions of the St. Lawrence, of the Mississippi, and even possibly of the Arctic drainage, united by these accidents to form the present complex.

One of the reasons for proposing this view is that there appears to be no continuous development of the system in any one direction. A river valley naturally broadens from its head to its mouth. The Great Lakes system does not do so, either toward the Mohawk, St. Lawrence or Mississippi. The St. Lawrence itself, it is true, does broaden eastward; but this is not connected with a similar change in that part of the system occupied by the Great Lakes.

Another argument against the belief that this region represents a single preglacial system is the fact that the drainage area is so small. In a number of places the divide is so close to the lake shore that we can see the lake from the divide, and nowhere is it far removed from it. It is true that the system has been robbed of some of its preglacial drainage;* but even restoring this liberally, there still remains a drainage area so small, with tributaries of large size so notably few, that the condition seems an impossible one for a large system. Moreover, in a river system hundreds of miles in length, there should naturally be an increase in the number of large tributaries as one passed down stream; but no such increase is noticed in the case of these lakes. In other words, they do not have the appearance of a part of a *single* large system.

Origin of the Lake Basins.—Whatever view has been prominently held concerning the preglacial history of this region, it has been uniformly agreed that during or immediately after the glacial

* Carll, Second Geol. Survey Pa. Rept. III, 1880, 330–397; Same, Rept. IIII, 1883, 169–175; Foshay, Amer. Journ. Sci., 1890, XL, 397–403; Chamberlin and Leverett, Amer. Journ. Sci., 1894, XLVII, 247–283; Brigham, Bull. Geol. Soc. Amer., IX, 1888, 183–210; Tarr, Bull. Amer. Geog. Soc., XXX, 1898, 379–382, 389–390, etc.

period, the preglacial valleys have been transformed to basins. It has been shown that in northern Europe and America the zone of abundant lakes lies within the glaciated belt. While we now know that most of these lakes are the result of irregular drift deposits, Ramsay advocated the view that many were due to ice erosion,* and suggested that the Great Lakes themselves were rock basins carved out by ice erosion.

It is to Newberry,† however, that we owe the full development of this idea of ice erosion as applied to the Great Lake basins. He recognizes Lake Superior as a synclinal trough, but believes that the other basins have been cut by some mechanical agent out of formerly continuous and nearly horizontal sheets of sedimentary strata. This mechanical agent he believes must be either ice, or water, or both. He notes that all have been filled by ice, and says,‡ "No other agent than glacial ice, as it seems to me, is capable of excavating broad, deep, boat-shaped basins like those which hold our lakes." The ice movement is favorable to this explanation.§ Others have followed Newberry in ascribing the lake basins to ice erosion in part at least.‖

Carll** believes that there were at first preglacial valleys which were somewhat enlarged by the glaciers, but mostly increased in size by subglacial waters. From his statement, it is not perfectly clear just how he accounts for all the facts by this action, and it is doubtful whether he would hold this view at the present time.

In his discussion of the Red River valley, General Warren ††

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* Quart. Journ. Geol. Soc., 1862, XVIII, 185–204; Amer. Journ. Sci., 1863, XXXV, 324–345; Physical Geology and Geography of Great Britain, 1872, 176.

† Proc. Boston Soc. Nat. Hist., 1862–63, IX, 42–46; Geol. Survey Ohio, 1869, 24–31; Ann. New York Lyceum Nat. Hist., 1870, IX, 213–234; Amer. Nat., 1870, IV, 193–214; Geol. Survey Ohio, Vol. I, 1873, 47–49, 174–184; Same, Vol. II, 1874, 21–65, 72–80; Proc. New York Lyceum Nat. Hist., 1874, II, 136–138; Geol. Survey Ohio, III, 1878, 32–51; Proc. Amer. Phil. Soc., 1882–83, XX, 91–95.

‡ Ann. New York Lyceum Nat. Hist., 1870, IX, 232.

§ See Newberry, Proc. Amer. Phil. Soc., 1882–83, XX, 91–95. See also Chamberlin's map of glacial striae, 7th Ann. Rep. U. S. Geol. Survey, 1888, facing p. 155.

‖ See, for instance, Logan, Geol. Survey of Canada, 1863, p. 889; Winchell (for Green Bay) Amer. Journ. Sci., II, 1871, 15–19; Russell, Pop. Sci. Mon., 1876, IX, 539–546; Gilbert, Forum, V, 1888, 417–428; Tarr, Bull. Geol. Soc. Amer., 1894, V, 339–356 (see criticism of this by Spencer, Amer. Geol., 1894, XIV, 134–135, and reply by Tarr, Same, 194–195).

** Second Geol. Survey Pa., Rept. III, 1880, 367–376.

†† Ann. Rept. Chief of Engineers, 1868, 307; Amer. Journ. Sci., 1878, XVI, 416–431.

brings forward evidence of tilting of the land; and Spencer,* who has vigorously opposed ice erosion, even to the extent of denying its potency as a partial agency, applies this change of level, which Gilbert had previously proved to have occurred in the Great Lakes region, to the explanation of the basins of the lakes. In his various papers he argues that the tilting of the land has actually closed some of the valleys, notably that of Ontario, transforming them to basins, so that the failure to find an outlet is not proof of ice erosion. According to Spencer, the differential elevation, which was greatest in the north and northeast, formed three lakes—Superior-Huron-Michigan, Erie and Ontario. Spencer affirms that the glacial striæ are not parallel to the lake basins and hence that the ice erosion theory is not tenable.

While others besides Spencer have argued against the glacial erosion theory,† perhaps the strongest argument against it is that by Claypole,‡ who holds that glaciers are not powerful enough to perform the work, and that the drift supposed to have been excavated from the basins does not exist to the south of them. Davis § says that the evidence of glacial erosion is very meagre, hardly more than proof that the valleys were occupied by ice (p. 341 in §). The rocks are nearly horizontal, and the lakes lie mostly in the softer rocks. Davis inclines toward drift obstruction of the river valleys as the chief cause for the basins (p. 362 in §). Upham ‖ believes the chief cause of the basins to be warping of the crust before, during and after the ice age. No doubt most of these writers, while advocating one cause as the prime one, would agree to the hypothesis that several causes have co-operated, as is stated

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* Proc. Amer. Phil. Soc., 1880–81, XIX, 300–317; Sec. Geol. Survey Pa., Rept. QQQQ, 1881, 357–406; Proc. Amer. Assoc. Adv. Sci., 1881, XXX, 131–46; Geol. Mag. 1887, IV, 167–173; Amer. Nat., 1887, XXI, 168–171; Proc. Amer. Assoc. Adv. Sci., 1888, XXXVII, 197–199; Bull. Geol. Soc. Amer., I, 1889, 65–70; Quart. Journ. Geol. Soc., 1890, XLVI, 523–533; Amer. Journ. Sci., 1891, XLI, 12–21; Amer. Geol., 1891, VII, 86–97; Proc. Amer. Assoc. Adv. Sci., 1894, XLIII, 237–43; Amer. Geol., 1894, XIV, 298–301; Pop. Sci. Mon., 1896, XLIX, 157–172; Amer. Geol., XXI, 1898, 110–123; 11th Rept. Niagara Comm., 1895, Appendix (reprint of several papers). For a more complete list of Spencer's papers, see second part of this paper in next number of the Bulletin.

† See, for instance, Lesley, Second Geol. Survey Pa. Rept. QQQQ, 1881, 399–401; Proc. Amer. Phil. Soc., 1882–83; XX, 95–101; Bonney, Nature, XLIII, 1891, 203–4.

‡ Proc. Amer. Assoc. Adv. Sci., 1882, XXX, 147–159.

§ Proc. Boston Soc. Nat. Hist., 1883, XXI, 315–381.

‖ Amer. Geol., 1896, XVIII, 169–177.

by Davis,* and by Russell,† who, though first advocating ice erosion, now believes them to be due to land movement and other causes.

Perhaps the broadest statement of origin of the Great Lakes is that by Chamberlin,‡ who ascribes the Great Lakes basins to the joint action of "preglacial erosion, glacial corrasion, glacial accumulation blocking up outlets, depression due to ice occupancy and general crust movements, together with possible unascertained agencies." This is certainly broad enough. Taylor§ believes in four causes—stream action, tilting of the land, obstruction by drift and deepening by ice action. He believes the basins to be mainly due to old river valleys which have been tilted and choked by deposits, but thinks that the ice sheet had little or no tendency to deepen.

As in the preceding section, it is difficult to select from these opposing views one which correctly explains the phenomena. That the basins are not due solely, or even primarily, to drift obstruction seems evident. It is inconceivable that there are buried and completely obliterated broad preglacial valleys; and, while we may agree that there *are deeply drift-filled valleys* between the lakes, it seems certain, from all the evidence, that these are *narrow* valleys formed in quite a different way from the broad, boat-shaped basins. The failure to find outlet channels, as, for instance, for the Ontario basin, may possibly be due to incomplete study; but it has been commonly assumed to prove that this basin is rock-rimmed, and all the evidence that we have tends to confirm this view. There could hardly be a valley over 700 feet deep and broad enough to form the continuation of the preglacial Ontario valley, which is so completely obscured by drift that not the least trace of it has been found on the surface.

I feel that we may safely say that the upper lake valleys are disconnected, excepting possibly by narrow cañons. The *possibility* of such connecting cañons as deep as the lake basins themselves cannot be denied, but the probabilities are very much against their existence. So we are to explain, if not a rock basin, at least a rock basin in all parts excepting where these undiscovered buried channels exist. In other words, we must account for the deep boat-shaped basins, the problem which Newberry attempted to solve.

Excepting Superior, which is stated to be in a synclinal valley,

* Proc. Boston Soc. Nat. Hist., 1883, XXI, 341, 362.

† Lakes of North America, 1895; Bull. Amer. Geog. Soc., 1898, XXX, 226–254.

‡ Proc. Amer. Assoc. Adv. Sci., 1883, XXXII, 212.

§ Dryer's Studies in Indiana Geology, Terre Haute, 1897, 92–93.

these basins are not due to structural causes. They lie in a region of nearly horizontal strata, so uniform in structure that the alternate expansion and contraction of the basins seems impossible on the assumption of mere river erosion. It is, however, proposed as a theory that a broad river valley, the preglacial St. Lawrence, has been warped so as to form these basins. That there has been warping, and that this has had marked influence on the form and depth of the lakes, must be admitted, as must also be the certainty that drift deposit in pre-existing valleys has tended to the same result. But to ascribe to such warping the predominant influence seems an extravagant use of the facts. It is a curious fact, if this explanation be true, that this particular region should have been selected for such warping, and have produced five great basins, when other valleys not far different, nor greatly removed from these, as, for instance, the Red River Valley of the North, where warping has also occurred, have not been transformed to basins. This, of course, is not an unanswerable argument against warping, but it may be pointed to as opposing evidence.

The warping has been complex, if it is the prime cause for the basins; and it has been considerable if it is the cause for the depth of 700 or 800 feet noticed in Ontario and Michigan; for, as has been pointed out before, we have to account for a *deep*, *broad* valley. Nearly the entire depth of each of these lakes must be accounted for by some other cause than river erosion, for it has been shown that the only possible valleys markedly below the lake levels are gorges, and hence that the only possible deep preglacial valleys along the sites of the present lakes, and markedly deeper than the present water surface, must have been gorges and not broad basins. So, in order to account for the basins by warping, we must assume warping to nearly the full extent of the present lake depth. Of such marked change in level there is no evidence either in the strata, or in the tilted beaches; and it is doubtful if such warping has actually taken place.

In various parts of New York and the neighboring States gorges are found, which some have ascribed to interglacial river action, others to the immediately preglacial uplift which rejuvenated the region. It is a significant fact that, although these deep valleys have been discovered along the lake shore, and buried gorges appear to connect some of the Great Lakes, there is no sign of their existence on the lake bottom, as we might expect if the lake basins were due to warping. While this is not necessarily proof of their absence along the lake bed, it is suggestive.

So far as I am able to interpret the facts at present known, while Superior is perhaps located in a structural valley, and Erie very probably represents a broad, shallow valley, somewhat obscured by glacial deposit and transformed to a lake largely by the northward tilting of the land, and while both drift filling and tilting can be admitted as partial causes for the other lakes, I am unable to accept the warped basin origin as the primary cause for the lakes. This leaves as the sole remaining explanation that of ice erosion. By this theory much, if not most, of the depth of the basins is ascribed to glacial erosion, operating to enlarge pre-existing valleys to boat-shaped basins.

It must be admitted that the process of elimination of other theories has probably not been complete enough to satisfy their advocates; and, perhaps, in this brief statement the argument has not been as clearly stated as it might have been. Enough has been said, however, to show that there are grave difficulties. Let us see if the ice erosion theory has equal objections. The argument *against* this theory has been very weak in the main. Contrary to opposing statements, the striæ *do* run in favorable directions, in the case of all the lakes excepting possibly Erie, which is least likely to be a rock basin of ice erosion origin. Professor Claypole's argument that there is not enough drift beyond the lakes to account for the basins through ice erosion would probably not now be repeated. As for Ontario, the lake concerning which I would especially speak, there is drift enough between its southern border and the Pennsylvania moraine, and directly in line with it, to fill it many times. It must also be remembered that a vast amount of the ice load of rock fragments went down toward and even to the ocean.

Professor Davis' statement, that the evidence in favor of the ice erosion theory is hardly more than proof of occupancy of the basins, scarcely does justice to Newberry's argument. Newberry's point that we have here several separated, boat-shaped basins, although never fully elaborated by him, is a point which must be considered as strong evidence for the theory. Spencer's chief argument against the ice erosion explanation, namely that ice cannot do this work, is based upon a personal estimate of the ability of ice, which he gained partly from theory and partly from observation on the *margin* of small Norwegian glaciers. One can scarcely study the existing Greenland ice cap and the American glacier deposits and still hold such a conception of the weakness of ice action. How Dr. Spencer reconciles his conception with the fact that the ice removed not

only the residual soil and partly decayed rock over large areas, but also considerable fresh rock, is difficult to understand.

I have often wondered whether those who object to ice erosion because of the immense work required, are not sometimes confused by the exaggerated vertical, which is necessary in cross section. I have heard people say that they did not believe glaciers were able to come down into a valley and dig a hole there. If one will draw a cross-section of the Ontario or the Lake Cayuga "hole," or will ascend to a hill overlooking such a lake as Cayuga, and see what a mere scratch the basin is compared with the valley itself, the difficulty of the ice erosion does not appear so great, as I well know from repeated experiments with students who have argued against the theory that Lake Cayuga is a rock basin.

In the long continued passage of the ice through a valley, a very little extra work done locally, where the rock is soft, or the ice deep, or its current more rapid than usual, would readily excavate a basin. Are there any reasons for believing that there might have been slightly more work done in the valley where Ontario now stands? The answer to this seems to be *yes*. In the first place there is the difficulty of otherwise explaining it; and, in the second place, there is the fact that the Great Lakes are grouped in a place where the ice from the Labrador region found free passage out over the south-sloping plains, which at that time were probably more freely sloping.

Coming down into these broad, preglacial valleys, which had possibly been deepened by cañon cutting in their bottoms, as the result of the elevation, the glacier passed through them; and the very fact that they were valleys gave to the ice greater power to excavate, as one may see so well illustrated in the rapidly moving valley tongues from the Greenland ice cap. The rigidity of the ice would prevent this excavation from being uniform, as it would be in the case of running water; and, as a result of this irregularity of work, rock basins would necessarily result. In the case of Ontario there is an added cause for deepening at the exact place where we find the valley. The Adirondack mountain mass obstructed the southward flow of the ice, deflecting some down the Champlain valley, but much more to the westward, so that the Ontario region was occupied by ice, coming not merely from the north, but also from the northeast. This must have meant more rapid movement and hence more rapid work at that place.

While I would not say that it is absolutely proved, I do hold that the ice erosion theory is the one to which the least serious objec-

tions can be offered. It seems a reasonable explanation for all the lakes, excepting Erie and possibly Superior, and has stood best the test of investigation; so well, in fact, that I feel warranted in putting it forth as the most probable of all the various theories, though with the distinct understanding that the effects of drift filling and warping are recognized as added causes for the present area and depth of all the lakes, and probably as the chief cause for Erie.

THE TIMBER LINE.

BY

HENRY GANNETT.

The upper limit of tree growth upon mountains differs greatly in altitude in different parts of the United States, in accordance with the range in latitude, in the elevation of the general surface of the country, in the exposure, and in the soil and rock conditions. The extremes are found on Mount Washington, N. H., where trees cease to grow at an altitude little exceeding 4,000 feet, and in southern Colorado, where they extend upward to over 12,000 feet.

The timber line is not a well-defined line across the mountain slope. For several hundred feet in altitude, the trees gradually diminish in height and symmetry, become more and more straggling and scattering, and finally end in detached clumps of nearly prostrate trunks, blown over into these attitudes by the wind. The line does not follow a contour around the mountain, but runs higher on southern slopes and in sheltered gulches and cañons, and lower on exposed northern slopes. On rocky mountains, timber does not climb as high as on those thickly covered with soil. On these accounts, measurements of the height of timber line are subject to some uncertainty, even when made with the greatest care, and it is never worth while to state them more closely than the nearest hundred feet.

The height above sea-level of the timber line on most of the mountain ranges of this country which rise above it has been measured. On Mount Washington, in the White Mountains of New Hampshire, its altitude is given as 4,150 feet. On Mount Marcy, in the Adirondacks of New York, it is 4,900 feet, showing a difference of several hundred feet, although these two groups of mountains are in nearly the same latitude. These two mountain groups, with Mount Katahdin in Maine, are the only ones east of the Rocky Mountains which rise above the level of tree-growth. The summits of the Southern Appalachians, although higher than the White Mountains, are far below timber line, owing to their more southerly latitude.

The Cordilleran ranges for the most part stand upon a high, broad plateau, extending from the northern to the southern boundary of the country, and extending over many degrees of longitude.

This plateau ranges in elevation from 4,000 feet to 10,000 feet above the sea, being highest in Colorado, and in that State the timber line is higher than anywhere else in the country. Many measurements of it have been made, showing an altitude ranging from 11,000 to 12,000 feet, with an average altitude of 11,500 feet. The differences are traceable to differences of latitude, or to difference in the height of the base of the mountain. Thus, Mounts Lillie, Park View and Arapahoe, Longs and James Peaks, on which timber line is given as 11,100, are in the northern part of the State. On Buffalo Peak it is 12,000; Mount Elbert, 11,900; Mount Harvard, 12,100; Mount Guyot, 11,800; La Plata Mountain, 12,000; Mount Lincoln, 12,000; Massive Mount, 11,600; Mount Princeton and Silverheels, 11,500. All these summits are in the central part of the State and rise from its highest plateau and valleys, in the midst of a perfect sea of high mountains. Pikes Peak, 11,700, a little further south, is the centre of a great mountain mass. In the southern part of the State are Rito Alto, with its timber line at 11,800; and Crestone, 12,100. Here the plateau is not as high as farther north.

In New Mexico, the altitude of timber line is no greater than in Colorado, since the effect of the more southerly latitude is offset by the diminished altitude of the plateau. In this Territory, outside of the Sangre de Cristo range, there are scarcely any mountains which reach the limit of timber; and in Arizona, but one peak, so far as known, San Francisco Mountain, rears its head into altitudes too great for tree-growth. On this ancient volcano, standing on a platform 7,000 feet above the sea, trees grow up to a height of 11,500 feet.

Going north and west from Colorado, we find, in the Uinta range, the timber line at an altitude of 11,100 feet, about the same as at the same latitude in Colorado. All other mountains of Utah are, or might be, were it not for aridity, or want of soil covering, timbered to their summits.

In the Wind River range of Wyoming, timber grows to an altitude of 10,200 feet; on Mount Washburne, Yellowstone National Park, to 9,900 feet; and on Sailor Mountain, east of the Park, it is 9,700. Still farther north, in Montana, it drops, on Mount Blackmore, south of Bozeman, to 9,500 feet; on Ward Peak, near the Three Forks of the Missouri, to 9,200; and on Mount Delano, near the north end of the Absaroka range, to 8,800. Going still farther north in Montana, the upper limit of timber growth seems to hold its altitude, for in the Flathead Forest Reserve, which extends from the

Great Northern Railroad to the northern boundary, and which includes the Front Ranges, the timber line maintains an average height of 9,000 feet.

The ranges to the westward in Montana and Idaho nowhere reach timber line, although the summits of many of them must approach it very nearly. It is not until we reach the Cascade range in Washington, that we find a true timber line again, and here it is much lower than in the same latitude in Montana. In northern Washington, it runs about 5,500 feet above the sea, rising to 6,500 on Rainier and the Cascades in its neighborhood. On Mount Hood, in northern Oregon, it is a little higher, say 7,000 feet, and it rises southward, reaching 8,200 feet at Crater Lake. On Mount Shasta, in northern California, it is 9,000; and on the Sierra Nevada, in central California, at Mono Pass, 10,750; while in southern California, in the San Bernardino range, Grizzly Peak, 11,700 feet, just reaches the limit of timber growth.

This sketch of the distribution of the timber line in the Cordilleras shows plainly the influence of the great elevated plateau on which the mountains stand, in increasing its altitude. Thus in Colorado, it is more than 1,500 feet higher than in the same latitude in California; in northwestern Wyoming, 2,000 feet higher than in Oregon; while in Montana, it is at least 3,000 feet higher than in Washington.

It is well known that this great plateau, although thousands of feet above the sea, has practically the same temperature as lowlands in the same latitude, owing to its great extent, and, since, as will be shown later, the height of timber line is essentially a question of temperature, this elevation of the timber line over these high plateaux is to be expected.

In the Cascade range, Sierra Nevada and San Bernardino range, is found a gradual and fairly regular rise of the timber line, from north to south, from 5,500 feet in northern Washington to 11,700 feet in southern California, a distance of 14° of latitude. As all conditions, except those incident to the differences of latitude, are much the same in these cases, we may examine this distribution as a question of latitude.

The following are the data in detail:

	APPROXIMATE LATITUDE.	TIMBER LINE.
Cascade Pass..................	48.30°	5,500
Mount Rainier.	46.51°	6,500
Mount Hood.................	45.20°	7,000

	APPROXIMATE LATITUDE.	TIMBER LINE.
Crater Lake	42.55°	8,200
Mount Shasta	41.25°	9,000
Mono Pass	38.00°	10,750
Grizzly Peak	34.15°	11,700

This table shows, in spite of some irregularities, an average change per degree of latitude of nearly 500 feet. If this rate continued northward, it would bring the timber line down to sea level in latitude 60°. We know, however, that in Alaska forests extend northward across the Arctic circle, and that in latitude 60° the timber line is about 3,000 feet above the sea, showing that the rate of descent of the timber line is not a simple function of the latitude, but that it diminishes as the latitude increases.

The ultimate and primary cause of the cessation of forest growth at great altitudes on mountain sides is to be sought for in temperature. This upper limit of tree growth is doubtless affected somewhat by the depth of the soil, by the steepness of slopes, by exposure to sun and to wind, and, in a few cases, by aridity, but these are all contributory agencies, and temperature remains the primary cause.

Within the United States, the mean annual temperature changes with each degree of latitude about 1°.7. At Duluth, Minnesota, in latitude 46° 47, it is 39°. At New Orleans, Louisiana, in latitude 30°, it is 67°.5. Also, the mean annual temperature changes 1° in every 300 feet, more or less, of abrupt ascent or descent. The observations of the Weather Bureau at Pikes Peak and Colorado Springs give for this factor 285 feet, and those at Mount Washington and Bethlehem, New Hampshire, give 290 feet. A change of a degree of latitude corresponds, therefore, to a change of elevation of about 500 feet, which is the amount which the timber line changes for each degree of latitude, as was above shown. This is not a coincidence, but a verification of the close relationship between timber line, temperature and latitude. For example, at Crater Lake, in latitude 43°, the timber line is 8,200 feet. A point at the same elevation in the latitude of Mono Pass, 38°, should have a mean annual temperature 8°.5 higher. If the timber line at Mono Pass has the same mean annual temperature as at Crater Lake, it would be 8°.5 x 300 feet higher, *i. e.*, 10,750 feet, which is precisely the observed altitude.

This leads naturally to a discovery of the mean annual temperature of the timber line. Knowing the height of timber line on a mountain and the altitude and mean annual temperature of a station

at its base, we have, with the rate of decrease of temperature with altitude, *i. e.*, 300 feet per degree, Fahrenheit, all the data necessary. I have computed it in forty-one cases, scattered widely over the country, with the following results:

DEGREES OF TEMPERATURE.	NO. OF CASES.
27	5
28	5
29	8
30	10
31	9
32	4

The mean of these figures is 29°.6. It may, therefore, be accepted that the mean annual temperature of timber line is 2 or 3 degrees below the freezing point.

The discordance among the results, which range over 6° of temperature, is probably due to the minor causes of variation in the elevation, such as slope, exposure, soil, etc. It is not due to differences of latitude, or of the altitude of the mountain's base, nor to difference in the species of trees, since the results show no order or system whatever in their discordance which suggest these causes. Mount Marcy in the Adirondacks, standing on a platform of slight elevation, with birch as the timber line tree, yields the same result as Mount Guyot, in central Colorado, much farther south, on a platform of 10,000 feet, and with *Pinus flexilis* as the timber line tree; so does Mount Rainier, Washington, whose base is little above sea level and whose timber line tree is the Alpine fir. In Colorado, where the major conditions are much the same, the results show quite as great a range as in the country at large.

HENRY GANNETT.

THE NAVY AS A MOTOR IN GEOGRAPHICAL AND COMMERCIAL PROGRESS.

BY

G. W. LITTLEHALES.

It is by victorious battle that a navy is heralded to the bosom of a people, and through the value of its peaceful pursuits that it is nurtured and sustained there. The spirit of honorable adventure which prompts voyages of exploration and the persistent striving against the obstacles of nature which results in the acquisition of fresh information and the discovery of new lands have placed the naval service of the United States among the forceful agencies of the nineteenth century in extending the confines of knowledge to a wider horizon and in opening avenues through which the industries of the people have poured millions of treasure into the nation's lap, and coördinated it with the missions of the Christian Church in bringing the people of distant lands within the generous folds of Western civilization.

Aside from guiding the sea-going shipping of a hemisphere by its Ephemeris and nautical charts, and aside from the considerable part which this service has taken in the discovery and delineation of the lands of the globe and in the collections of the plants, animals, and ethnological material which form the basis of our national institutions for the increase and diffusion of knowledge concerning the arts of life, is its grand contribution to our knowledge of the sea brought about by the impulse which it was the first to give to deep-sea sounding to which submarine telegraphy owes so much, and by its investigations into the laws of the winds and currents of the ocean through which, for commercial purposes, antipodal points have been brought nearer together by many days' sail.

Before the time of the project for the Atlantic telegraph cable there seemed to be no practicable value attached to a knowledge of the depths of the sea and, beyond a few doubtful results obtained for purely scientific purposes, nothing was clearly known of bathymetry, or of the geology of the sea bottom. The advent of submarine cables gave rise to the necessity for an accurate knowledge of the bed of the ocean where they were laid, and lent a stimulus to all forms of deep-sea investigation. While the apparatus for sounding the sea consisted of a weight secured to the end of a hempen cord

which was paid out from a simple reel on the deck of a vessel, no reliability could be attained in the measurement of depths, because the cord employed, in order to be strong enough to haul the sinker in, was necessarily so large as to become a controlling element in the weight of the system. The few attempts to sound that were made during the first half of the present century gave rise to the reports of the vast depths of the sea that astonished the public mind fifty years ago. Lieutenant Berryman of the United States brig *Dolphin* reported an unsuccessful attempt to fathom mid-ocean with a line thirty-nine thousand feet in length. Captain Denham, of her Britannic Majesty's ship *Herald*, reported bottom in the South Atlantic at a depth of forty-six thousand feet; and Lieutenant Parker, of the United States frigate *Congress*, in attempting to sound the same region, let go his plummet and saw fifty thousand feet of line run out after it as though the bottom had not been reached. The deepest spot in the South Atlantic is not more than twenty thousand feet beneath the surface; and the deepest spot yet discovered in the world not more than thirty thousand feet.

For the development of accurate knowledge of the depths of the sea the world will ever be indebted to the genius of Midshipman Brooke, of the United States Navy, who, somewhat after the middle of the century, made the first great improvement in deep-sea sounding by inventing an implement in which the sinker, enveloping a tube secured to the sounding line, was detached on striking the bottom and left behind when the tube was drawn up. This invention paved the way for the adaptation of piano-forte wire to successful use as a sounding line, and led up to the inventions of Commander Sigsbee who, besides contributing by his inventive genius most of the instruments used in modern deep-sea research, in 1875 achieved the crowning triumph of the art in his elaborate deep-sea sounding machine, by which, while relieving the delicate sounding wire from the sudden strains to which it would otherwise be exposed by the pitching of the ship while lying to for the purpose of sounding, the profoundest depths are measured with celerity and exactness.

THE UNITED STATES EXPLORING EXPEDITION.—Scarcely a decade had passed after the close of the second war for independence before there began to be discernible among our people a feeling that the nation had not shared in geographical exploration to an extent commensurate with her maritime importance. It was near the end of the period of great geographical discoveries among the island

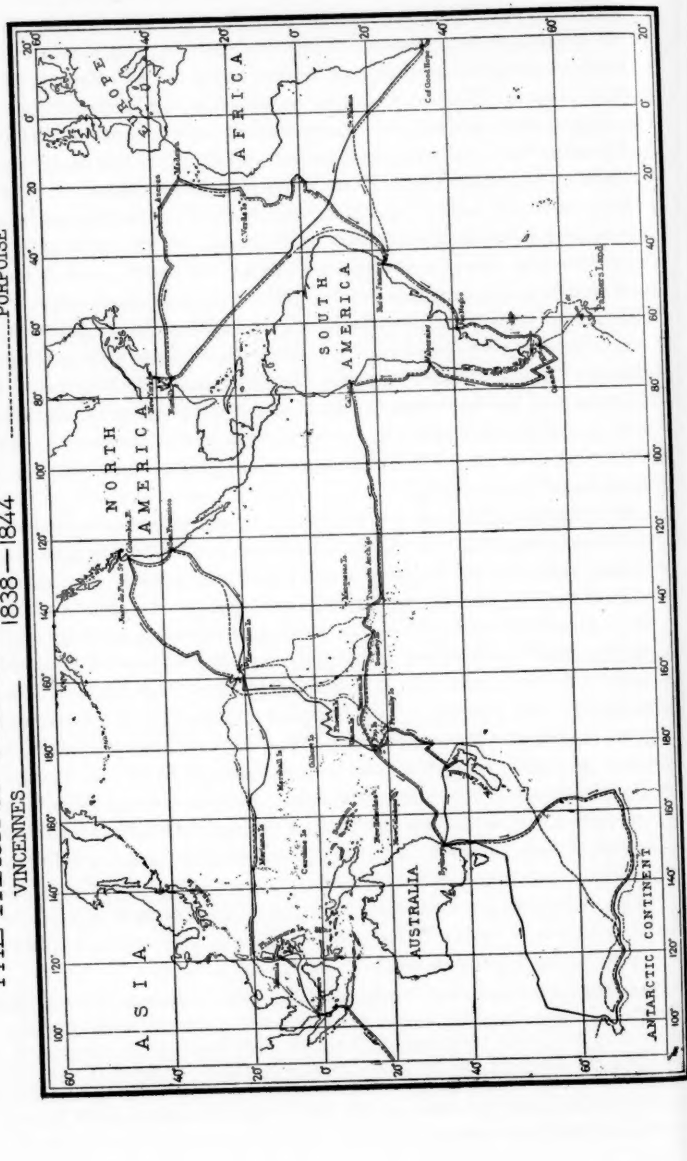
groups of the Pacific Ocean, but at a time when little of that part of the world had been even rudely charted, and when much remained to be disclosed concerning its physical nature, and the characteristics of vegetable, animal, and human life there. Vessels of the British, Dutch, French, Portuguese, Russian, and Spanish governments had been dispatched to the Pacific on voyages of discovery and exploration, but their researches had left the Fiji and Samoan islands, and the groups now known as Micronesia unknown, in comparison with the knowledge that had been ascertained concerning the Society Islands, the Friendly Islands, the Hawaiian Islands, and New Zealand. So vast is the extent of Polynesia and so hastily were the first explorations conducted and so inadequate the equipment of the voyagers for gathering geographical information that it was often difficult to identify their discoveries and sometimes impossible for the discoverers to return to the islands discovered. The inaccuracy of the observations upon which islands, rocks, and shoals were located was constantly exemplified in the occurrence of shipwreck and disaster to those who were obliged to navigate by the charts based upon them.

At this period there was no nation whose commercial interests were more important in the Pacific than the United States. The whaling fleet of this country at that time comprised more than six hundred vessels having an aggregate capacity of 200,000 tons, or one-tenth of the total tonnage of the United States, giving employment to twelve thousand men, and requiring a capital then estimated at $12,000,000. In the year 1835 the produce of this fleet amounted to $5,607,000. The dangers incurred by this large number of vessels through deficient geographical knowledge were considered as a sufficient justification for the expenditure necessary to equip and maintain an expedition for the improvement of these poor conditions, but besides this was the incentive for further discoveries in the Antarctic regions growing out of a well established impression that a continent existed in the region of the South Pole.

The instructions issued by the Navy Department in August, 1838, to Lieut. Charles Wilkes, who had been selected to command the Exploring Squadron, state

"that Congress having in view the important interests of our commerce embarked in the whale fisheries and other adventures in the great Southern Ocean, by an Act of the 18th of May, 1836, authorized an Expedition to be fitted out for the purpose of exploring and surveying that sea, as well as to determine the existence of all doubtful islands and shoals, and to discover and accurately fix the position of those which lie in or near the track of our vessels in that quarter and may have escaped the observation of scientific navigators."

THE TRACK OF THE UNITED STATES EXPLORING EXPEDITION
1838—1844
VINCENNES———— ---------PORPOISE



According to the tenor of these instructions, the researches in astronomy, terrestrial magnetism, and meteorology, and the hydrography and geography of the seas and countries to be visited were confided to the naval officers of the Expedition, while a corps of civilian scientists consisting of Horatio Hale, philologist, Charles Pickering and T. R. Peale, naturalists, Joseph P. Couthouy, conchologist, James D. Dana, mineralogist, William Rich, botanist, Joseph Drayton and Alfred T. Agate, draughtsmen, J. D. Brackenridge, horticulturist, was distributed among the different vessels for the purpose of promoting the acquisition of knowledge and extending the bounds of science.

Wilkes sailed from Norfolk on the 18th of August, 1838, with a squadron composed of the *Vincennes*, *Peacock*, *Porpoise*, *Sea Gull*, *Flying Fish*, and *Relief;* and, after crossing the Atlantic Ocean to Madeira and recrossing to the coast of South America, refitted his ships in the harbor of Rio de Janeiro and then proceeded southward along the continent of South America to the Strait of Magellan which was reached in February, 1839. Although its chief field of operations was to be in the Pacific, observations in every branch of inquiry that fell within the scope of the Expedition were carried on throughout the progress of the squadron in the Atlantic, and resulted in an important contribution to our knowledge of the parts visited.

Immediately upon the arrival of the squadron in Orange Bay, Tierra del Fuego, preparations were made for a cruise in the Antarctic regions with the purpose of exploring Palmer's Land which, it was supposed, would be reached in the vicinity of the Ne Plus Ultra of Capt. Cook, the famous British navigator. Many surveys were made in the Patagonian Archipelago and the region to the southward of Cape Horn was penetrated and explored as high as the 70th degree of latitude before the Expedition turned northward along the west coast of South America.

Upon the departure from Callao in July, 1839, to commence the operations in the Pacific, the squadron was reduced to four vessels. The *Sea Gull* had been lost in penetrating the Antarctic seas, and the *Relief* had been ordered home by way of the Hawaiian Islands and Australia with directions to leave stores for the Expedition at Sydney, and to make various geographical researches on the way. To realize the magnitude of the operations that Wilkes with his patience, intelligence, energy, and courage carried on for the benefit of the nation and for civilization, let it be stated that he was then entering an imperfectly explored region covering ten million

square miles, or one-fifth of the earth's surface, and studded with more than 1,800 islands and many thousand reefs. In the course of three years his command visited and described the Tuamotu Archipelago, the Society Islands, the Samoan Islands, the Friendly, Ellice, Mulgrave, and Gilbert groups, the Hawaiian and Philippine Islands, and, coursing from the Columbia River and Puget Sound at one end of the Pacific to the Philippines, New Zealand, and Australia at the other, charted more than five hundred islands and atolls together with one hundred harbors indenting their shores, and accompanied them by sailing directions and determinations of the tides and currents. So well and completely was the geographical and hydrographical work done in the Low Archipelago, the Samoan, Friendly, Gilbert, and Mulgrave groups and in the Hawaiian Islands that, to this day, the charts of those regions issued to mariners are based upon the surveys by this Exploring Expedition. Series of magnetic observations for declination, dip, and intensity were made at fifty-seven stations and the diurnal variation of the needle was observed wherever time permitted the erection of an observatory for that purpose. For the determination of the Southern Magnetic Pole, observations were contributed from 35° easterly to 59° westerly declination, between longitudes 97° and 165° east of Greenwich, nearly on the same parallel of latitude; which gave numerous convergent lines through the space leading to its position. At each of the important points of the cruise an observatory was established for determining longitude by observations of moon-culminating stars and latitude by circum-meridian observations of celestial bodies: meridian distances were established throughout the route by the transportation of chronometers for time, and every opportunity was taken to deduce the true positions of islands and reefs by observations made on shore.

Frequent observations of the temperature of the sea were made at different depths, surface currents were observed, and meteorological phenomena were carefully registered. The number of drawings brought home amounted to two thousand sheets, including those relating to costumes, scenery, and natural history. Large collections in every branch of natural history were secured; in botany about ten thousand species were obtained, including about one hundred specimens of living plants among which were several East Indian fruits that were rarely found in American and European conservatories; in geology and mineralogy much industry and research were expended, and about eleven hundred species of crustacea were figured, comprising many new forms illustrative of gen-

eral anatomy and physiology; and a vast museum of the implements, dress, ornaments, and manufactures of these distant peoples was formed, and continues until the present to lend an important means of studying the conditions of uncivilized man in the remote quarters of the globe.

Passing from the Samoan Islands to Australia, the *Vincennes*, *Peacock* and *Porpoise* prepared for the mission which so much fascinated Wilkes and which led to his brilliant achievement in the discovery of an Antarctic continent lying southward of Australia. The three vessels headed south from Sydney on the day after Christmas in 1839, and falling in with the land in latitude 64° south, and longitude 158° east of Greenwich on the 16th of January following, skirted the new continent to the eastward as far as longitude 97° east. Returning to Sydney he announced his discovery in the following words, in a report to the Secretary of the Navy, dated March 11, 1840:

"It affords me much gratification to report that we have discovered a large body of land within the Antarctic Circle, which I have named the Antarctic Continent, and refer you to the report of our cruise and accompanying charts, inclosed herewith, for full information relative thereto."

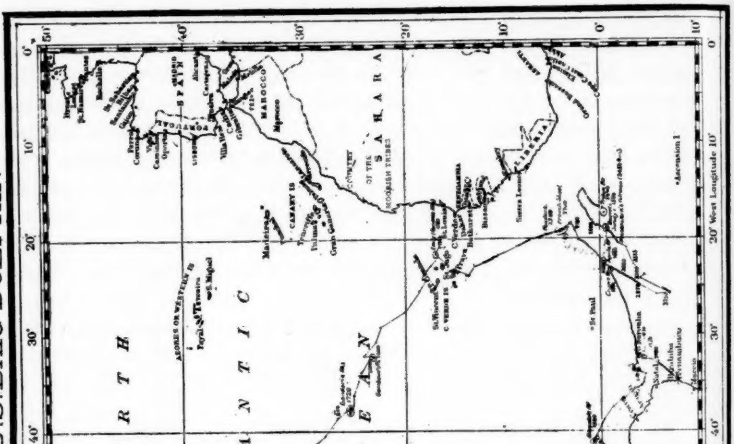
By the summer of 1841 Wilkes had again worked his way through different groups of the Pacific Archipelago and through the waters which separate British Columbia from what is now the State of Washington, to San Francisco, then in the Mexican province of California, and, setting sail from there, crossed the Pacific Ocean to the Philippine Islands by way of Hawaii, little thinking that he was traversing the route which was to become, within the lifetime of children then born, the great highway between the holdings of his country in the Pacific.

Leaving Manila, the Indian and Atlantic seas mirrored the progress of home-coming ships that bore not only the greatest single contribution that America has made to foreign geography, but also the researches out of which grew the "Chronological History of Plants," the "Races of Men," the "Comparative Grammar of the Polynesian Dialects," and the splendid volumes on Geology, Zoophytes and Crustacea, on Botany, and on Ethnography and Philology containing the studies, which have laid the foundation for all subsequent researches concerning the languages and migrations of the Polynesians and the peopling of the islands of the Pacific Ocean.

THE CRUISE OF THE U. S. BRIG DOLPHIN.—In the fall of 1851 the U. S. brig *Dolphin*, under the command of Lieutenant S. P.

Lee was commissioned for a cruise of research which had an important bearing upon the commerce of the world. For more than one hundred and fifty years there had been accumulating upon the charts of the North Atlantic representations of rocks and shoals,

THE CRUISE OF THE U.S. BRIG DOLPHIN



frequently growing out of the vague reports of mariners resulting from misleading appearances of the sea and from mistaking one region for another, through the imperfect means formerly used by many navigators for determining geographical positions at sea. It

is unaccountable that no one of the great maritime nations had up to that time authorized an official search for these charted dangers, which were constantly delaying vessels by causing them to avoid the localities of the dangers, or rendering navigation uneasy or unsafe by neglecting this precaution. Besides being charged with the duty of investigating fifty-six of these doubtful dangers, with a view of definitely locating them upon the charts or else disproving their existence, the *Dolphin* was at the same time to be employed under the Act of Congress of March 3, 1849,

"for testing new routes, and perfecting the discoveries made by Lieutenant Maury in the course of his investigations of the winds and currents of the ocean."

To this latter end an hourly record was kept throughout the cruise of the force and direction of the wind, of the kind and direction of the clouds, of the readings of the barometer and thermometer, of the temperature of the water, of the limits of the currents and their force and direction, of the transparency and saltness or specific gravity of the sea water, and of its temperature at various depths.

The *Dolphin* was provided with means for sounding the ocean at great depths and made numerous measurements all along the track of the expedition which, as laid down in the instructions from the Navy Department, was first toward Europe and through that portion of the ocean around and to the northward of the Azores, in which many dangers had been reported to exist; thence westward to the Gulf Stream between 30° and 35° north latitude; thence easterly to examine the regions lying between the equator and 7° south latitude, and between 15° and 25° of west longitude, supposed to be volcanic and remarkable for its oceanic disturbances and tide rips; thence from the equator to Cape San Roque, sounding and carefully examining the currents between Fernando de Noronha and the mainland; thence after having satisfactorily examined the equatorial and Amazonian currents, homeward, crossing four times over a strip of the sea remarkable for its temperatures, lying about 150 miles wide on each side of a straight line drawn from 37° west longitude on the equator to Cape Charles, Virginia.

The *Dolphin* returned to the United States in the summer of 1852, after an absence of eight months, during which the navigation of the Atlantic had been made safer, and important contributions had been collected for the advance of meteorological knowledge and for the improvement of the existing notions concerning the physics of the ocean and its bathymetry.

EXPLORATIONS AND SURVEYS IN THE VALLEY OF THE AMAZON.— In 1851 the Government of the United States, impressed with the importance to this country and to all Christendom of opening the valley of the Amazon to trade and commerce, sent an expedition under the direction of the Navy Department to explore this river and its tributaries and to gather information not only respecting the condition of the valley at that time with regard to the navigability of its streams, to the number and condition, both industrial and social, of its inhabitants, to its climate, soil, and productions, but also respecting its capabilities for cultivation, and the character and extent of its undeveloped commercial resources, whether of the field, the forest, the river, or the mine.

While negotiations were in progress to obtain the consent of Brazil to the proposed exploration, Lieutenant William L. Herndon, then serving on the west coast of South America, was detached from the service afloat and directed to proceed to Peru and Bolivia for the purpose of collecting, from the archives of the monasteries and from other authentic sources, information concerning the headwaters of the Amazon. He succeeded in obtaining much knowledge that proved valuable in his subsequent duties as senior officer of the expedition, and he also made extensive investigations into the condition of the silver mines of those countries and into the probable effect upon them of the opening of the Amazon to commerce

The expedition was organized at Lima, Peru, in the Spring of 1851, and proceeded inland from the Pacific coast. They had not gone more than sixty miles from the seaboard before they found the waters of the Amazon sparkling at their feet and starting off to the eastward to go singing to the sea. At Tarma the expedition was separated into two parties; the first under Lieutenant Herndon proceeded by the Ucayali to the Amazon and thence throughout the whole course of that river to Pará, and the second under Lieutenant Gibbon, passing southward through Peru and Bolivia and down the eastern slope of the Andes and embarking upon the Mamoré River at Cochabamba, descended that river to the Madeira and thence to the Amazon.

Both parties were many months in drifting down, and though their food was of the coarsest kind and often scanty, they performed their duties with honor to themselves and credit to the country.

The results of their observations are published in two large octavo volumes of the Congressional documents, and include a complete meteorological journal, together with soundings of the

depths of the waters through which they passed and the geographical positions of important points and places.

In 1878, the Navy Department sent the U. S. S. *Enterprise*, under the command of Commander T. O. Selfridge, Jr., to survey the Amazon and Madeira. From the results of this work, the Navy Department published navigational charts of the Amazon up to the bar of the Rio Negro, and of the Madeira up to the falls of San Antonio. These charts have been translated into foreign measures and foreign tongues, and to-day the commerce of the world in the valley of this, the most majestic and mighty river of the world—whether it be considered in respect to the volume of water discharged, or to the extent of its navigability, or the area of the country drained by it—is guided by the charts of the Naval Service of the United States.

The Naval Expedition to Japan.—From the time that the islands of Japan were first visited by European nations, until the middle of the present century, efforts had been constantly made by the various maritime powers to establish commercial intercourse with that country, whose large population and reputed wealth held out great temptations to mercantile enterprise. Portugal was the first to make the attempt and her example was followed by Holland, England, Spain, Russia, and finally by the United States. All these attempts, however, had thus far been unsuccessful, the permission enjoyed for a short period by the Portuguese to trade with the islands, and that granted to Holland to send annually a single vessel to the port of Nagasaki, hardly deserving to be considered exceptions to this remark. China was then the only country that carried on any considerable trade with Japan.

So vigorously was this system of exclusion carried out by the Japanese that foreign vessels were not permitted to enter their ports in distress, or even to do an act of kindness to their own people. In 1831 a Japanese junk was blown out to sea and, after drifting about for several months, was cast ashore near the mouth of the Columbia River in Oregon. An American ship, the *Morrison*, undertook to carry the survivors of the crew back to their country, but on reaching the Bay of Yedo, she was fired into from the neighboring shore. She repaired to another port of the island, but meeting with the same reception there, she returned to America with the Japanese on board.

When vessels were wrecked or driven ashore in Japan, their crews were subjected to the most cruel treatment. In the year 1846

two American whaling ships, the *Lagoda* and the *Lawrence*, were wrecked on the shores of the Island of Honshiu and their crews were captured and treated with great barbarity. It is believed that their lives were only spared through the intercession of the Dutch Governor of Desima, at Nagasaki.

That the civilized nations of the world should have thus submitted to such treatment by a weak and semi-barbarous people can only be accounted for on the supposition that, from the remoteness of their country, instances of such treatment were of rare occurrence, and the difficulty of chastising them very great. It can hardly be doubted that, if Japan were situated as near the continent of Europe or America as it is to that of Asia, its people would long before this time have been treated as barbarians, or else would have been compelled to respect those usages of civilized states of which they had been receiving the protection.

The Government of the United States had made two attempts to establish commercial intercourse with Japan. In the year 1832, a Mr. Roberts was appointed a special agent of the Government with authority to negotiate treaties with sundry nations in the East, and among others, with Japan; but he died before he arrived in that country. In 1845 Commodore Biddle was sent with two vessels of war to visit Japan and to ascertain whether its ports were accessible. He was cautioned however "not to excite a hostile feeling, or a distrust of the Government of the United States." He proceeded to Yedo, but was told that the Japanese could trade with no foreign nations except the Dutch and the Chinese, and was peremptorily ordered to leave the islands and never to return to them.

By the middle of the century the valuable interests of our country growing out of the acquisition and rapid settlement of our vast territory bordering on the Pacific, the discovery of gold in that region, the navigation of the ocean by steam, the rapid communication established across the isthmus that separates the Atlantic from the Pacific, had so multiplied in the seas of the East that our intercourse with those parts of the world was already greatly increased and gave promise of such important future extension, that the duty of protecting the American citizens whose vocations called for the navigation of those seas could no longer be deferred on the part of the Government of the United States. Accordingly, in November, 1852, under the authority of the President of the United States, the Navy Department organized an imposing naval expedition to proceed to the Empire of Japan under the command of Commodore

Matthew Calbraith Perry, an officer of great prudence and firmness, for the purpose of opening negotiations to bring this estranged but cultivated people into the family of nations, and for the further purpose of exploring the coasts of Japan and of the adjacent continents and islands, and collecting the hydrographic information necessary for the construction of charts.

The expedition was at first designed to consist of the steam frigates *Susquehanna* and *Mississippi*, the steamers *Princeton* and *Alleghany*, the corvette *Macedonian*, the sloops *Plymouth*, *Saratoga* and *Vandalia*, and the storeships *Supply* and *Southampton*; but by April, 1853, only the *Susquehanna*, *Mississippi*, *Plymouth*, *Saratoga* and *Supply* had assembled on the coast of China, and in the latter part of May, leaving the *Plymouth* at Shanghai to guard the interests of resident citizens of the United States against the effects of the prevailing rebellion, Commodore Perry proceeded with the *Susquehanna*, *Mississippi*, *Saratoga* and *Supply* to the Liu Kiu Archipelago, a dependency which the Empire of Japan had conquered centuries before, but whose sovereignty was then disputed by the Government of China. Here a port of rendezvous was established at Naka, and by kindness and gentle treatment on the part of the Americans a friendly intercourse with the inhabitants grew up, during which exhibitions of the daguerreotype, the magnetic telegraph, the submarine armor and other scientific apparatus were made, to the utter astonishment of the people.

While waiting at Naka to conciliate and gain the confidence of the people of Liu Kiu before venturing to visit Japan, the Commander-in-Chief sailed in June for the Bonin Islands with the *Susquehanna* and *Saratoga* and entering Port Lloyd, the principal harbor of the group, established there a port of refuge and refreshment for our vessels traversing those distant seas. He caused the principal islands to be explored and a few animals to be placed upon two of the groups as a commencement of a provision for future wants, and he also distributed many varieties of garden seeds among the settlers, and held out to them hope that implements of husbandry would be furnished. The journal of the Expedition contains a good geographical description of the Bonin Islands, and an account of the survey of Port Lloyd, a chart of which was made for the use of our Government after the return to Naka, and subsequently transmitted to Washington, together with charts of the ports of Naka and Melville, of the Liu Kiu group. Satisfied with the disposition of the Liu Kiuans, the squadron, joined by the *Plymouth*, which had come from China, sailed for Japan in July and, entering the Bay of

Yedo, opened communications with the Emperor of Japan. Perry conducted himself with admirable dignity and address and, overcoming or carrying along a multitude of obstacles born of fear, deceit and intrigue, succeeded in bringing about a satisfactory interview with a first counsellor of the Empire.

The propositions of our Government having been presented to Japan, and extensive surveys of waters before unknown to foreigners, and extending to within a few miles of Yedo, carried on during the progress of the negotiations, having been concluded, the Commodore declared his willingness to await a reply until his return in the ensuing spring, and withdrew his squadron to the coast of China, with the exception of the *Plymouth*, which was despatched to the Bonin Islands to explore the interior of the islands and obtain information respecting their geological formation, the character of the soil, the quality of the timber for mechanical purposes, the animals, birds and reptiles, and the kinds and descriptions of fishes in the neighboring waters. During the winter of 1853 and 1854 a detachment was left at Naka to look out for the coal sheds which had been built there, to keep in their proper places the buoys which had been planted in the harbor, and to board outside and pilot into port such vessels as appeared off the harbor. Writing about this time to the Navy Department, Perry said:

"It is self-evident that the course of coming events will ere long make it necessary for the United States to extend its territorial jurisdiction beyond the limits of the Western Continent, and I assume the responsibility of urging the expediency of establishing a foothold in this quarter of the globe, as a measure of positive necessity to the sustainment of our maritime rights in the East."

All through the winter during which the vessels of the squadron went from place to place on the coast of China in answer to appeals for protection on the part of American merchants residing in the various maritime cities, the Commander-in-Chief, well knowing that the ultimate success of his mission to Japan would depend entirely upon the means that he might secure for overawing a people remarkable for their sagacity, was making strenuous efforts with the Government at Washington to secure the additional vessels that were originally named to accompany his squadron.

He sailed from China early in the year 1854 with an imposing squadron of seven vessels and again arriving in the Bay of Yedo on the 13th of February, he landed with great pomp upon the shores of Japan and accomplished the great object of effecting an advantageous compact, which secured protection and kind treatment to all Americans who might, by chance or design, find themselves in

any part of the Empire of Japan, and which also stipulated that vessels of the United States should be entitled to obtain shelter and supplies, and secured privileges to our citizens never in the two preceding centuries conceded to any foreign people. It will be worth the while of those who know the glories of the Empire of Japan at the close of the nineteenth century to read this treaty, and see, in the opening of the treaty-ports of Simoda and Hakodate, the initiation of the wealth of Japan, intellectual and superior, her ideas and spirit, her achievements and enterprise, her abundant food supply, the sinews of war, and the inventions of peace.

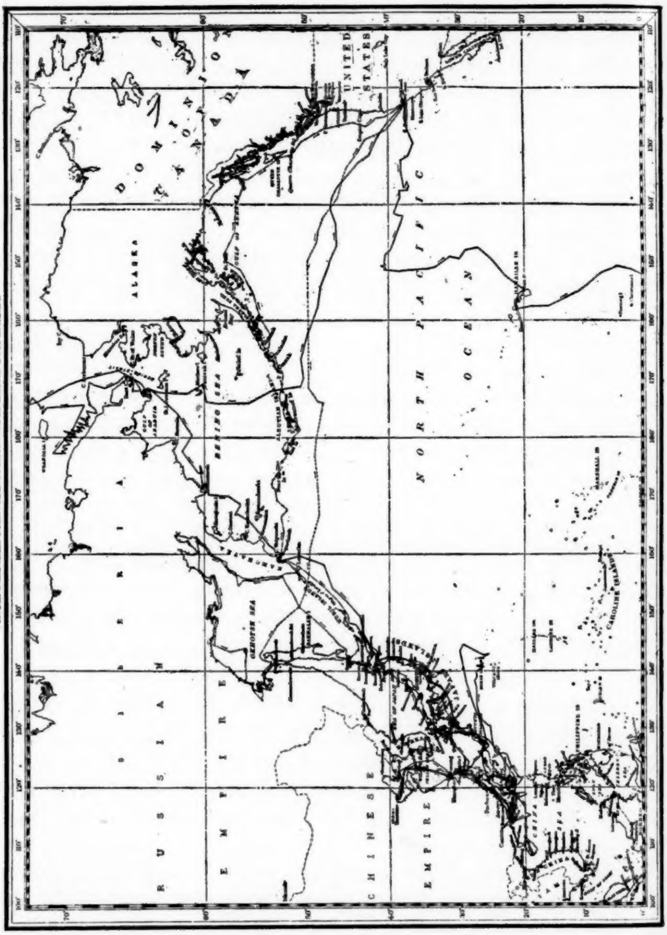
Thus did a naval commander reflect new honors upon the service to which he belonged and secure for his country, for commerce and for civilization a triumph whose blessings have enriched our own generation, and whose full fruition will be reaped in generations yet to come.

THE UNITED STATES NORTH PACIFIC SURVEYING EXPEDITION.—During the same year in which the Naval expedition to Japan was organized, a second expedition, somewhat allied in character and importance to the operations of Commodore Perry's squadron, was equipped for the exploration and survey of the China seas and the Northern Pacific. This expedition was authorized by an Act of Congress of August, 1852, which appropriated a large sum of money for use "in prosecuting a survey and reconnaissance for naval and commercial purposes of such parts of Bering Straits, of the North Pacific Ocean, and the China seas, as are frequented by American whale-ships and by trading vessels in their routes between the United States and China."

This cruise of exploration and survey, whose field of labor was to be in the Tropics as well as in the Arctic, was designed to extend over a period of three years. The vessels of the expedition were the U. S. Ship *Vincennes*, one of the staunchest and best sloops-of-war of that time, the propeller *John Hancock* and the brig *Porpoise.*

The command of the expedition was first assigned to Commander Cadwallader Ringgold, an officer who had already distinguished himself by his former participation in work of a like nature; and, to promote the scientific objects, an astronomer and hydrographer, a naturalist, and a botanist were appointed as a part of his staff. The vessels were to sail directly for the Pacific early in 1853, doubling Cape Horn, and proceeding by way of the Hawaiian

Islands, to Bering Strait, in time to commence work at the opening of the season for surveying operations in that quarter. It was designed that the expedition should be employed in the reconnaissance of these high latitudes from June until October during each



TRACK OF THE U.S. NORTH PACIFIC SURVEYING EXPEDITION
1854-1856
VINCENNES___JOHN HANCOCK___FENIMORE COOPER___

of three successive years. The remaining part of each year was to be devoted to the prosecution of surveys and explorations in the lower latitudes, on the coast of Japan, in the China seas, and along the routes of navigation between our ports on the Pacific and the

East Indies. Particular attention was to be given to the survey of the seas and coasts through and along which our sailing ships were accustomed to pursue their trade.

Secretary John P. Kennedy wrote concerning this expedition:

"Being persuaded that the Department cannot better contribute to the fulfilment of the high expectations, which the country has ever entertained as to the value of the navy, nor perform a more acceptable duty to the navy itself than by imparting to this arm of the national power the highest spirit of enterprise as well as the greatest efficiency of action, I have sought every opportunity to put in requisition for useful service the various talent, skill and ambition of honorable adventure, which equally distinguish and embellish the professional character of the officers under the control of the Department. Constant employment of ships and men in the promotion of valuable public interests, whether in the defense of the honor of our flag, or in the exploration in the field of discovery and the opening of new channels of trade, or in the enlarging of the boundaries of science, I am convinced will be recognized both by the Government and by the people, as the true and proper vocation of the navy, and as the means best calculated to nurse and strengthen that prompt and gallant devotion to duty which is so essential to the character of accomplished officers, and so indispensable to the effectiveness of the naval organization."

The expedition, which was to have started early in 1853, did not leave Norfolk until June of that year, and the plan of reaching the Pacific by way of Cape Horn was changed in favor of the passage by the way of the Cape of Good Hope and the Indian Ocean. The storeship *John P. Kennedy* and the tender *Fenimore Cooper* were added to the squadron.

In due time the squadron reached Simons Bay, Cape of Good Hope, and from there proceeded to Hongkong, the *Vincennes* and *Porpoise* going by way of Van Diemens Land (Tasmania), through the Coral Sea, passing the Caroline and Ladrone and Bashee Islands, and arriving at Hongkong on the 17th of March, 1854. The *John Hancock*, *John P. Kennedy*, and *Fenimore Cooper* sailed through Sunda and Gaspar straits, the Carimata and Billiton passages, and the Sulu Sea, and arrived at Hongkong early in June, 1854.

During the absence of Commodore Perry with the greater part of the East Indian squadron in Japan, the civil war raging at that time in China, and particularly in Canton, so alarmed citizens of the United States residing in Hongkong, that Commander Ringgold considered it proper to suspend the special duties which had been assigned to him, and to render protection to his exposed countrymen. He thus failed to accomplish a large portion of the surveys which had been planned for the year 1854, and Commodore Perry, upon arriving at Hongkong, finding the expedition laboring under serious disadvantages owing to an affliction of Commander Ringgold, which necessitated the return of that officer to the United

States, placed the next ranking officer, Lieut. John Rodgers, in charge of the expedition, which left Hongkong early in September, 1854, the *Vincennes* proceeding eastward to survey the Bonin Islands, the Liu Kiu group, and the islands to the westward, and the *John Hancock* and *Fenimore Cooper* sailing northward through Formosa Channel into the Yellow Sea. After surveying Bullock Harbor, these two vessels proceeded northward to Shanghai, and thence to the Gulf of Pechili, reaching the mouth of the Pei Ho in November, 1854. Here a survey was made of the entrance of the river, as well as of Miao Tao Strait and of the approach to Shaluitien Banks. The expedition returned to Hongkong in February, 1855, with the exception of the *Porpoise*, which parted company with the *Vincennes* on September 24, 1855, in mid-channel between Formosa and the coast of China, to the northward and westward of the Pescadores, and was never heard of again. She was probably lost in a typhoon of great intensity which occurred about a month after the separation, and in which the *Vincennes* narrowly escaped. After performing certain duties, the *Porpoise* was to have met the *Vincennes* in the Bonin Islands. Having waited there somewhat after the appointed time, the *Vincennes* went in search of her without finding any clue to her fate. Subsequently the *John Hancock* and the *Fenimore Cooper* thoroughly explored the Pescadores Islands and the shores of the Island of Formosa, but without bringing tidings of the fate of the *Porpoise*. The expedition again left Hongkong in March, 1855, to complete the survey of the lands between Liu Kiu and Japan. The *Vincennes* and *Hancock* then sailed along the east coast of Japan and surveyed Shimoda Harbor and the adjacent coast. At Shimoda Commander Rodgers had to intercede with the Japanese authorities in behalf of two American families who had taken up residence there and whom the Japanese, in their construction of the treaty, then recently concluded by Commodore Perry, would not allow to stay longer at that place. From Shimoda the two vessels continued northward to Hakodate, with the steam-launch of the *Vincennes* under command of Lieutenant John M. Brooke running inside close along the shore, making observations and doing surveying work. At Hakodate they were joined on June 5, 1855, by the *Fenimore Cooper*, which vessel had sailed through Korea Strait, and thence along the west coast of Japan into Tsugaru Strait. After surveying Hakodate and Tsugaru Strait, the *Vincennes* and *Fenimore Cooper* steamed along the southerly border of the Kurile Islands and reached Petropavlovsk, on the east coast of Kamchatka, on July 7, 1855.

Meanwhile the *John Hancock* had left Hakodate in the beginning of July, 1855, and passed through Tsugaru Strait into the Sea of Japan and thence northward close along the west coast of the island of Yezo, making a reconnaissance of the coast; then through La Perouse Strait into the Okhotsk Sea. Crossing to Kamchatka, she ran along the east shore of the Okhotsk Sea and then along the north coast to Ayan on the west side of the sea where a harbor survey was made. From Ayan this vessel proceeded southward and then eastward into the Gulf of Amur, and, after surveying there, left on September 16, rounded the north point of Sakhalin Island the next day, and, taking a southeasterly course, passed through Amphitrite Strait into the Pacific Ocean; and, continuing eastward, reached San Francisco on October 19, 1855, six days after the arrival of the *Vincennes*, and eight days after that of the *Fenimore Cooper*.

The *Vincennes* and the *Fenimore Cooper* made a survey of Avatcha Bay and approaches, including the harbor of Petropavlovsk. After finishing this work the two vessels separated to take up different routes of survey. The *Fenimore Cooper* proceeded to Atka Island, in the Aleutian group, to make inquiries regarding the fate of the officers and crew of the whale-ship *Monongahela*, which was supposed to have been lost, in the autumn of 1853, in attempting the passage between Seguam and Amukhta Islands during a gale. These islands were thoroughly examined and diligent inquiry was made at Atka, but no trace of the crew was obtained. The *Fenimore Cooper* then steamed along the south side of Unmak Island to Dutch Harbor, Unalaska. Leaving this harbor on September 5, 1855, the homeward trip was made along the Alaskan coast and islands, to Sitka, and thence southward along the North American continent to San Francisco, which was reached on October 11, 1855.

The *Vincennes* left Petropavlovsk on July 14, and entering Bering Strait on the 16th, reached the harbor of Glasenapp, on the Asiatic continent, on August 1. After surveying this harbor and the straits of Seniavine, Commander Rodgers left a party under Acting Lieutenant Brooke, with the steam-launch of the *Vincennes*, at Glasenapp Harbor to make observations during his absence in the North. He proceeded northward for the purpose of verifying the position of land, placed upon the charts on the report of Captain Kellet, of H.M.S. *Herald*, in about latitude 72° North, longitude 175° West, and to examine, if possible, Plover Island, reported to have been seen by the same officer, and then endeavor to reach

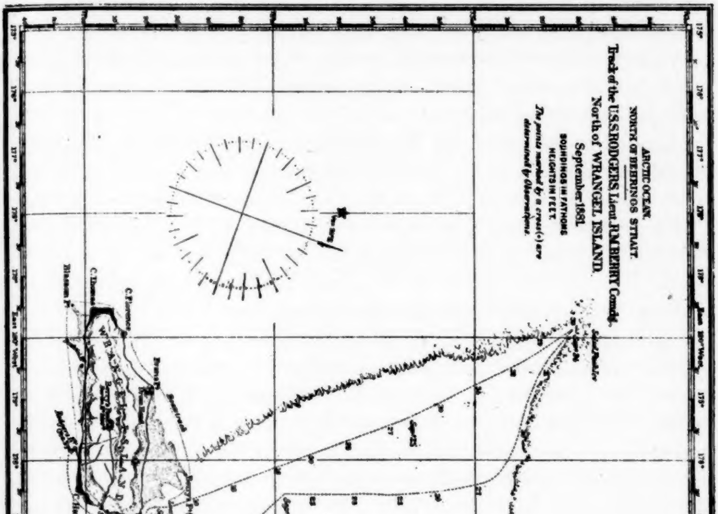
Wrangel's Land, described to Wrangel by the natives as visible in clear weather from Cape Yakin. Running over the end of Herald shoal, he passed Herald Island and stood to the northward until he passed over the position of the land shown on the British Admiralty chart, and came to anchor in 42 fathoms in latitude 72° 05′ North, longitude 174° 37′ West. It was so clear that the horizon was apparently without limit. No land could be seen from the royal yards, and the water so far as the vision could reach was free from ice. Rodgers then returned to Herald Island, the southeast point of which he determined in 71° 21′ North, 175° 20′ West. From the summit of this island no land could be seen in any direction although the horizon was clear. Running towards Plover Island, when half way from its alleged position his progress was arrested by a barrier of ice. No land could be seen from the masthead though the air was clear. He concluded therefore that the island did not exist and expressed the opinion that Captain Kellet must have been misled by appearances.

Running for Wrangel's Land—which at the time had never been seen by Europeans—when within 10 miles of its reported position in the open sea in latitude 70° 41′ North, longitude 177° 21′ East, he was again arrested by a barrier of ice and reluctantly turned about to the southward without having had a glimpse of the reported land. Curiously enough it was the vessel named after him, the U. S. S. *Rodgers*, which, 26 years later, under the command of Lieutenant R. M. Berry, U. S. N., succeeded in reaching and charting this land.

Having attained the limits proposed by him and penetrated, up to that time, further north than anyone else in the directions selected, he sailed southward, stopping at Lutke Harbor, St. Lawrence Bay, long enough to survey it, and then proceeded to Glasenapp Harbor, where he took on board Lieutenant Brooke and his party. Continuing southward through Bering Sea and Amuhkta Pass, he turned to the eastward on the homeward track to San Francisco, where he arrived on October 13, 1855, and found the *Fenimore Cooper* already in port.

The *Vincennes* remained at San Francisco until February of the following year, and after having been refitted, made another cruise of exploration and survey, sailing westward to about the meridian 151° West, searching for doubtful dangers, and then southward to Hilo Bay, Island of Hawaii. Having surveyed this bay and visited Honolulu, she returned to the United States by way of Cape Horn, arriving at New York on July 13, 1856.

Fifteen charts of harbors and special localities and twenty charts of island groups and extensive coasts and seas, among which was the first American chart of Bering Sea, resulted from the geographi-



cal work of this expedition. The natural history results, deposited in the Smithsonian Institution with those of Commodore Perry in Japan, Captain Page in the La Plata region, Lieutenants Herndon

and Gibbon in the valley of the Amazon, Captain Lynch in the Dead Sea, and Captain Hall in the Arctic regions, were of great magnitude, and embraced many new and rare species that were collected by the naturalists Stimpson and Wright, of the Scientific Corps of the Expedition, first under Commander Ringgold in the South Pacific and China seas and afterwards largely increased by those secured around Japan, Kamchatka, in the Bering Sea and Arctic Ocean, and on the Californian coast.

Upon the return of the Expedition the Secretary of the Navy wrote as follows:

> "Commander Rodgers and his officers are entitled to the highest commendation for the ability and energy with which they have prosecuted the work to which they were assigned, and I have no doubt their labors will prove not only of great benefit to commerce but also interesting contributions to science."

THE EXPLORATION OF THE VALLEY OF THE LA PLATA AND ITS TRIBUTARIES.—Stimulated by the fruits of the exploration of the valley of the Amazon, the Navy Department issued instructions to Commander Thomas J. Page, of the United States Steamer *Water Witch*, to "survey and explore the River La Plata and its tributaries." He was also accredited at the same time by President Fillmore to act individually or jointly with our ministers near the governments of Brazil and Argentina to make a treaty of commerce and navigation with the republic of Paraguay.

The *Water Witch*, a steamer of about 400 tons burden, with a draft of 9 feet, sailed from Norfolk on the 8th of February, 1853. Although not adapted in all respects for the duty assigned to her, she, nevertheless, was better suited to it than any other vessel at that time available; and with an enlightened zeal for the promotion of commerce and the advancement of science, the Department availed itself of the limited means thus at its disposal for arriving at the objects of the expedition. The seal to the new waters, which the *Water Witch* was destined to explore and which had so long remained closed to navigation, had just been broken by a declaration on the part of the liberal and enlightened Provisional Director of the Argentine Confederation. The Government of the United States, promptly availing itself of this privilege, had now the satisfaction of demonstrating to the world the navigability of some waters previously unknown and of others to a far greater extent than had at any time previously been imagined. The *Water Witch* ascended the Paraná river to the point where the Paraguay flows into it, a distance of about 800 miles from Buenos Ayres; and then, passing by the Paraguay river through Paraguay and into

Brazil, reached the Brazilian military post of Corumba, situated more than 1,700 miles distant from Buenos Ayres. From the La Plata to Asuncion, which is farther from the mouth of the Rio de la Plata than St. Louis is from the mouth of the Mississippi, the depth of water found was no less than 20 feet. An equal depth was found for a distance of several hundred miles above Asuncion, and the expedition had ascended the Paraguay 700 miles above this place before less than 12 feet was encountered. Throughout this great journey on the Mississippi of the Southern hemisphere, the *Water Witch* met neither sawyer nor snag, nor was she interrupted by any bar or shoal.

This voyage was a refutation of the idea, held up to that time, that the commerce of these inland countries could never be carried on directly with the United States or Europe because vessels suited to the seas could not navigate these interior waters. The expedition disclosed the fact that steamers of four times the tonnage of the *Water Witch* could ascend these rivers at all seasons of the year nearly as far as the *Water Witch* had penetrated. It proved that some of the richest provinces of Brazil, whose products had before no outlet but the port of Rio de Janeiro, which was reached by laborious, dangerous and costly land travel, were directly accessible to steam navigation.

In addition to making these demonstrations concerning the Paraná and Paraguay rivers and their bordering provinces, Page traversed the Salado river for 800 miles and revealed the existence of a navigable water way through a region of surpassing richness, which had up to that time been regarded as a desert.

Throughout the extent of these explorations, the officers carried on a running survey based upon and checked by daily astronomical observations, and accompanied by numerous soundings of the depths of the rivers. From this survey, embracing an extent of river course of 3,600 miles and of actual exploration or travel by land of 4,400 miles, a series of charts were afterwards published which continued to serve for many years as a guide to the commerce of all nations upon the tributaries of the La Plata.

The acquisitions of the expedition in the domain of natural history were of the greatest importance to science and the industrial arts. They were comprehensive in character and, in the language of a distinguished naturalist of the Academy of Natural Sciences at Philadelphia:

"embraced specimens of quadrupeds, birds, reptiles, fishes, insects, crustacea, shells, minerals, plants, living and dead, with seeds and sections of wood, fossil

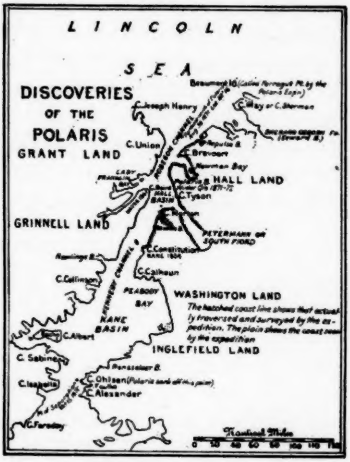
remains of fishes, &c. The aggregate is one of great magnitude, and may safely be said to constitute by far the largest collection ever made in South America by an American expedition. Notwithstanding the difficulties of preservation consequent upon the hot, moist climate, the specimens brought home are all in the finest possible condition. The collection is especially rich in the larger birds of Paraguay; in the hawks, eagles, ducks, geese, macaws, curassows, &c., several of which are believed to be new to science, and few of them previously brought to the United States.

"The fishes are in great variety, and will illustrate the formidable and rapacious character of all the inhabitants of the fresh waters of South America in being universally provided with sharp cutting teeth. A considerable proportion of all these are believed to be undescribed, as also of the invertebrata."

THE NAVY IN THE ARCTIC ZONE.—The middle of the nineteenth century saw the close, in the habitable portions of the globe, of the period of coast reconnaissance and island discovery which followed the period of circumnavigation and continental discovery; but the sea was unfathomed, the world had scarcely reached the threshold of the domain of oceanography, and within the northern hemisphere—the world's seat of population, wealth, and enlightenment—there remained a totally unknown area of the Frigid Zone of the extent of nearly three million square miles, within which were locked many facts of high importance to commerce and navigation and in the application of science to the arts of life. Within a half century new Arctic lands have been added to the map of the world, new whaling grounds have been discovered by which millions of dollars were added to the commerce of the United States, new species of birds, of animals, and of fishes have been found, and the knowledge has been turned to commercial as well as scientific value; minerals of value, not known to exist elsewhere, have been brought from the Arctic; interesting studies in ethnography and kindred sciences have been made, and our knowledge of the magnetism, meteorology, electricity, and of ocean currents has been greatly increased by the facts gathered in the penetration of these new regions.

In 1870 the President of the United States issued a special commission to Charles Francis Hall and directed him to report to the Secretary of the Navy for the organization of an Arctic polar expedition. By his energy, intrepidity, and perseverance, Hall had already attained results in Arctic explorations that were worthy of attention and of the patronage of the Government, which was implied in the Act of Congress appropriating money to support the expedition which he was about to command. A tug of 400 tons burthen, which had been laid up since the close of the Civil War,

was fitted out at the Washington Navy Yard to make the voyage, and significantly renamed the *Polaris.* The fearful proofs of the perilous adventure need not now be retold. The expedition passed through the waters between Greenland and British America as far as 82° 16′, an extent beyond all previous navigation toward the North Pole. More than seven hundred miles of coast line were discovered or recharted, and it then became known that Kennedy Channel extended beyond Cape Constitution, the highest point reached by Kane's Arctic Expedition, and that another body of water, which Captain Hall named Robeson Channel, in honor of the Secretary of the Navy, opens to the northward and has a very perceptible current toward the south. From the summit of an elevation, near the point at which the party wintered in 1871 and 1872, the land was seen extending as far north as the 84th degree of latitude. The scientific corps established an observatory at these winter quarters in Polaris Bay, in latitude 81° 38′, and made astronomical observations to determine its geographical position, pendulum observations for gravity, and also magnetic, meteorological, geological, botanical, and zoological investigations. They found Hall Land, the name given to the northward extension of Washington Land, to be comparatively rich in flora and fauna, and succeeded in enumerating eight species of mammals, twenty-three species of birds, fifteen species of insects, and seventeen species of plants.



Captain Hall died at Polaris Bay in the Winter of 1871, and the expedition, attempting to return, was shipwrecked and so delayed in reaching the United States that the Navy Department sent out a relief expedition, in the course of which the U. S. S. *Juniata*, Commander D. L. Braine, the U. S. S. *Tigress*, Commander James A. Greer, and the *Little Juniata*, Lieutenant G. W. De Long, obtained results that still further added to the fruits of the original expedition.

De Long returned from this relief voyage imbued with the spirit

of Arctic investigation, and continued to urge the organization of another expedition until he was appointed to command the *Jeannette*, a vessel of American register, owned by Mr. James Gordon Bennett of New York, which Congress had authorized the Secretary of the Navy to accept and take charge of for purposes of North Polar exploration by way of Bering Strait. This ship, having been repaired, strengthened and fitted out at the San Francisco Navy Yard, sailed on the 8th day of July, 1879, with a complement of four commissioned naval officers besides Captain De Long, two civilian scientists, and twenty-four seamen enlisted under the naval regulations for special service; and, proceeding through Bering Strait, passed to the northwestward into the open space between the American and Siberian ice-packs, with the object of reaching the North Pole.

THE JEANNETTE IN THE PACK

Map showing her Drift to and fro with the ice and the line of the Crew's Retreat, as charted at Irkutsk by Lt. J. W. Danenhower, U.S.N.

She was frozen in almost immediately, and drifted with the ice-pack in a general northwesterly direction, as shown by the accompanying chart, over a shallow sea of an average depth of 30 fathoms to a position in 77° 15′ and longitude 156° 06′ east of Greenwich, where she was abandoned in the middle of June, 1881, in a sinking condition, after having been twenty-one months in the ice. The expedition then proceeded southward with sledges and boats, and the survivors reached the Lena Delta, in Siberia, about the middle of September of the same year. The new lands discovered by De Long appear upon the chart as Jeannette, Henrietta and Bennett Islands; and the observations made on board the *Jeannette* form a large and important contribution to the data of terrestrial physics.

In June, 1881, the U. S. S. *Rodgers*, Lieutenant R. M. Berry commanding, left San Francisco under the orders of the Navy

Department to search for tidings of the *Jeannette* Exploring Expedition in the Arctic Ocean. In the course of the fruitless attempt to penetrate the ice, the officers of the *Rodgers* first surveyed Herald Island, and afterwards circumnavigating and charting Wrangel Island, proved conclusively that what was formerly called Wrangel Land, and supposed by some geographers to be a part of the Asiatic continent, and by others a part of Greenland, is in reality an island about seventy miles long and thirty-five miles broad, in the south-eastern coast, of which, formed by a bight in the coast line, is a small but excellent harbor of moderate depth of water.

With a view of affording every possible means of relief to the Jeannette Expedition, the Navy Department determined, at the same time with the sending of the *Rodgers* through Bering Strait, to dispatch the U. S. Steamer *Alliance*, Commander G. H. Wadleigh, to the waters between Greenland and Spitzbergen. Subordinated to the orders relating to the main mission of the *Alliance* were the instructions issued to the commanding officer to make the fullest observations practicable of sea temperatures and other oceanic phenomena, including phosphorescence and specific gravity, with specimens from the surface and the bottom of the sea. Bench-marks were established at Saxe Haven, Iceland, and at Hakluyt's Headland, Amsterdam Island, for tidal and hypsometrical observations in accordance with the aims of the International Arctic Commission. The *Alliance* penetrated to latitude 80° 10′, and brought back floral and geological collections, specimens of birds and animals, and a large amount of important hydrographical data.

COMMUNICATION FROM PROF. GEO. DAVIDSON.

THE GEOGRAPHICAL SOCIETY OF THE PACIFIC,
SAN FRANCISCO, CAL.,
March 16th, 1899.

To the Council of the Geographical Society of the Pacific,
San Francisco, Cal.

GENTLEMEN:

In several Government documents the statement is made that the area of the Philippine Islands is something over 114,000 square miles. In the latest one just received it is given as 114,326 sq. m.

The error has doubtless arisen from a hurried examination of the Spanish documents.

We find in the "Guía Oficial de las Islas Filipinas, para 1898; Publicada por la Secretaría del Gobierno General; Manila 1898," the statement that the Archipelago comprises an area of 335,000 square kilometres, without including the Joló (Sulu) Group.

It then specifies about thirty of the principal Islands, and their areas aggregate 298,485 square kilometres. That of course leaves a multitude of the smaller islands not specified in the Guide, but covered by the larger area.

With the relation that the number of square kilometres multiplied by 0.386,052 will give the number of square miles, the area of the islands specified amounts to 115,238 square miles; and the area of all the islands less the Joló group, amounts to 137,057 square miles.

Further, the statement is generally made that the Archipelago of the Philippines contains from 1,000 to 2,000 islands; and the "Guía Oficial" says the number is more than 1,200.

But in examining the "Derrotero del Archipiélago Filipino, Madrid," 1879,—that is the Coast Pilot of the Philippines, covering more than 1,200 pages—we find that the Islas, Islitas, Isletas, Islotes, Islotillos and Farallones therein described amount to 583. Of course this does not include reefs, rocks or hidden dangers.

I submit that these figures of the areas, and of the number of islands and islets, be accepted by the Society until replaced by Government Surveys.

Very respectfully,
GEORGE DAVIDSON,
Prest.

SEVENTH INTERNATIONAL GEOGRAPHICAL CONGRESS, BERLIN, 1899.

BUREAU OF THE ACTING COMMITTEE.
90 ZIMMERSTRASSE, BERLIN, SW.
January, 1899.

SUGGESTIONS REGARDING THE WORK OF THE CONGRESS.

The Acting Committee of the Berlin Meeting desiring to enhance the value and efficiency of the International Geographical Congress in general and of the Berlin Meeting in particular, begs to submit to representative scholars of geography and cognate sciences some suggestions regarding a regulation of the mode in which propositions and motions presented to, and approved by, the Congress may be treated with the view of attaining practical success. Its members ask their fellow-students kindly to consider these intimations and to declare their opinions on them.

1.

A review of the subjects treated at previous meetings, as well as of those which from the London Meeting are likely to be transmitted to that of Berlin, appears to show that within the sphere of operations devolving upon geographical congresses generally the following categories may be distinguished:

A. The reading of papers, or the delivery of discourses, on the results of scientific work or travels, or on geographical topics which may be otherwise of general interest;

B. The discussion of propositions relating to the international introduction of homogeneous designations and methods within the whole range of geographical sciences;

C. The deliberation of suggestions referring to the international execution of practical tasks either by geographers alone, or together with representatives of other departments of science.

2.

The subjects to be treated by the Berlin Congress are subdivided among the following groups, noticed already, with a slight difference of wording, in the circular of invitation, viz.:

I. Mathematical geography, Geodesy, Cartography, Geophysics;

II. Physical geography (Geomorphology, Oceanology, Climatology);
III. Biogeography;
IV. Anthropogeography (Industrial, Commercial, and Political geography; Ethnology);
V. Topical geography, Travels of exploration;
VI. History of Geography and cartography;
VII. Methodology, School geography, Bibliography, Orthography of geographical names.

These groups are meant primarily to mark the scope and the limits of the matter which may be treated. It is not intended to arrange sections corresponding to them, but special conferences may be held with reference to one or another of these groups.

3.

For the Berlin Congress there have been hitherto announced:

A. A few discourses relating to the results of the Deep Sea exploring expedition conducted by Mr. Chun, and to travels in Central Asia and Southern Africa.

B. Several propositions relating:

1st, to international homogeneousness in the methodical treatment of various subjects, such as the problem of the tides, the signatures on maps, the nomenclature and delimitation of oceans and seas, the apposition of the scale to every map, the mode of arranging meteorological tables, etc.

2d, to the general introduction of centesimal standards of measures and scales, of reckoning the meridians from 0 to 360, and the hours from 0 to 24.

Another proposition, which takes in view the introduction of an international orthography of geographical names, has been submitted at Berne and discussed in London, whence it is likely to be transferred to the Berlin Meeting.

C. Suggestions for joint international work:

1st, in collecting materials of every kind referring to floating ice, to earthquakes, to the utilization of arid lands, etc.;

2d, in the exploration of the Antarctic regions;

3d, in the systematical exploration of the oceans.

4th. A suggestion, dating from former congresses, and which is again to be discussed at Berlin, refers to the execution of an international geographical bibliography. It appears that this will be finally disposed of at Berlin.

5th. Another important subject, dating from the Meeting of

Berne, is Prof. Penck's well-known project of the construction of a Map of the World on the scale of 1 to 1000000. It is to be hoped that this scheme will be presented to the Berlin Meeting in an advanced stage.

4.

The full list of subjects already announced as to be submitted to the Berlin Congress shows that propositions and suggestions play a prominent part, and it is likely that the number of either will considerably increase. As the Acting Committee, however, does not consider it advisable to overcharge the program of the Congress with matter insufficiently prepared by incorporating into it every idea or proposal brought forward by one single individual, it has drawn up the following regulations:

a. For papers and discourses the rules will apply which are laid down in the circular of invitation.

b. Every proposition or suggestion should be presented in writing before June 1st, 1899. It should be attended by a short exposition of the motives on which it is based, and be seconded by at least one other person of scientific standing.

c. Every motion adopted for discussion should be introduced at the Meeting by the proponent, and he should be assisted by a second reporter.

d. When a practical task is proposed, a statement of the ways and means, which may appear likely to lead to its accomplishment, should be joined to the accompanying motivation.

e. All communications referring to subjects which are desired to be treated by the Congress will be delivered for registry and examination to a Scientific Subcommittee.

f. The report of this Subcommittee will as a rule be decisive for the drawing up of the program of the Congress by the Acting Committee.

5.

It appears to be one of the most important and most difficult problems of the International Geographical Congress to give efficiency to resolutions which it has passed, by devising means for putting them into practice. A number of suggestions of more or less value have been submitted to every meeting. So far as they could not be disposed of by a simple vote, each of them has generally been entrusted for further deliberation to a committee specially appointed for the subject. Only in a few instances, however, the widely dispersed members of these committees appear to have met

and consulted during the interval of time between two meetings, and many a valuable suggestion has therefore been either abandoned, or reproduced in an unaltered state.

The meetings of the Congress are evidently too far apart as to allow suggestions of acknowledged importance to be carried into practical effect, if this is made dependent on deliberations restricted to the assemblies themselves. It should therefore be taken into consideration, whether means and ways may be found for sufficiently promoting important suggestions during the long intervals of time so as to allow them either to be presented to the next meeting in an advanced stage, or to be carried into practice at once. This applies more particularly to great practical tasks submitted to the Congress and accepted for promotion by formal resolution.

The Meeting of Berne has already made an important step forward by resolving that the Bureau of each meeting shall remain in function until the next assembly, in order to watch the carrying out of the resolutions passed.

But another step in advance of even greater weight may be made. Each Congress ought to authorize its Bureau, conjointly with a Permanent International Committee (or, if found more convenient, the latter alone), to take such measures as these bodies shall deem fit for carrying into effect those tasks for which the Congress has resolved to engage itself, as has been done with admirable success by the International Geological Congress with regard to the construction of the geological map of Europe. Subcommittees, specially elected for every single task, may be entrusted with the practical work, while the Bureau and the Permanent Committee should have the power to provide for the required means, and if it should not be possible to create a working fund in any other way, to apply in the name of the Congress to the governments of States for financial assistance. Funds will be required, in the first instance, for rendering possible the conferences of the committees by providing for the travelling expenses of their members, and, in the second place, for instigating practical work.

The endeavors of the undersigned Acting Committee to accomplish this object would be considerably relieved if Members of the Congress would kindly express their opinions as to the feasibility of this scheme and, at the same time, would indicate ways and means to carry it into practice. The Committee would then be in the advantageous position of being able to lay before the Congress propositions approved beforehand by scientific authorities.

It is requested that communications and remarks referring to

papers to be read, or to suggestions and propositions to be presented, or to any subject whatever noticed in this circular, may be sent to the address of the Seventh International Geographical Congress as early as possible.

THE ACTING COMMITTEE,

GEORG KOLLM,
Secretary-General.

F. VON RICHTHOFEN,
President.

PHYSIOGRAPHIC NOTES.

BY

RALPH S. TARR.

GEOLOGICAL INFLUENCE ON PLANT DISTRIBUTION.—Much has been written about geographical distribution of plants in a large way, but very little has appeared upon small areas. An interesting paper in the latter connection has recently been prepared by Hollick (*American Naturalist, 1899, XXXIII, 1–14*), who considers the distribution of trees in New Jersey with reference to the geological structure. He finds that there are really three zones, (1) the zone of the deciduous trees in the northern part, (2) the coniferous zone near the sea coast, and (3) what he calls the tension zone between the two. The coincidence of these zones with belts of different geological formation is very striking, and suggests the relation of cause and effect. It would be exceedingly interesting if this study could be carried far enough to include other plants than the forest trees. This paper by Hollick suggests the possibility of important studies in geographic distribution made by those who are able to appreciate the geological and soil conditions, as well as the botanical names of the plants collected.

RECENT EARTH MOVEMENT IN THE GREAT LAKES REGION.—The evidence of past uplifts in the region of the Great Lakes and elsewhere has given some geologists reason for thinking that the land might still be in motion. In the September number of the *National Geographic Magazine, 1897*, Mr. G. K. Gilbert gave an abstract of certain studies which he had made upon evidence of recent earth movement. A more complete statement of his studies has now appeared (*18th Annual Report U. S. Geological Survey, pp. 595–647, 1898*), including a careful record of his data and an analysis of the apparent results to be deduced from them.

Gilbert had four pairs of stations, each pair being connected by a northeast and southwest line. From bench marks at these places observations upon the change in lake level have been carried on for from 20 to 37 years. A careful study of these shows that in each case the bench mark at the northeastern end appears to have risen, the amount varying in different cases, but the average giving the result of an increase of about forty-two hundredths of a foot per 100

miles, per century. While this result is small, and there are certain possibilities of error in excess of the result, the two facts (1) that such a change is to be expected in exactly this direction, and (2) that in all four cases the same general result has been obtained, are considered by Gilbert as practically proving the fact of tilting. He says, "It seems to me that the harmony of the measurements and their agreement with prediction from geologic data make so strong a case for the hypothesis of tilting that it should be accepted as a fact, despite the doubts concerning the stability of the gages." Nevertheless he proposes a plan for more precise future measurement which, if followed, will settle the question definitely, for it is certain that many will not consider that the fact of tilting is now proved.

Gilbert adds to his paper an abstract of the botanical studies made by Moseley, which seem to show that some of the islands on the south shore of Lake Erie have been formed by the partial drowning of the land through tilting, and he finds evidence that this drowning had recently been in progress.

If Gilbert's conclusions are correct, and if the tilting continues to proceed uninterruptedly at the rate calculated by him, very important changes will result in the course of time. In this connection Gilbert says that the water of the Great Lakes will eventually flow into the Illinois River past Chicago, as it once did. Upon this point he states, "Evidently the first water to overflow will be that of some high stage of the lake, and the discharge may at first be intermittent. Such high-water discharge will occur in 500 or 600 years. For the mean lake stage such discharge will begin in about 1,000 years, and after 1,500 years there will be no interruption. In about 2,000 years the Illinois River and the Niagara will carry equal portions of the surplus water of the Great Lakes. In 2,500 years the discharge of the Niagara will be intermittent, failing at low stages of the lake, and in 3,500 years there will be no Niagara. The basin of Lake Erie will then be tributary to Lake Huron, the current being reversed in the Detroit and St. Clair channels."

It is to be presumed that if nature is really engaged in this particular work of overturning, as we now know she has been in the past, man will prevent the success of the effort. It would be most disastrous to many cities already well established, particularly in the Canadian provinces, to have withdrawn from them the water supply which has been so important in determining their location.

A STUDY OF CHRISTMAS ISLAND.—In the Indian Ocean, south of Java, is a tiny island rarely visited by Europeans, and inhabited by

but very few men. This island, known as Christmas Island, is interesting to the zoologist and botanist because it represents a mid-oceanic island upon which the flora and fauna have been very slightly modified by man; and a study recently made by Andrews (*The Geographical Journal*, *1899*, *XIII*, *17–35*) shows that it is of marked physiographic interest also.

The island consists of a rim of reef rock, reaching an elevation of 1,170 feet at the highest point, in the interior of which is a depression which closely simulates the form of a partially completed atoll. On the seaward side of the raised rim of this saucer-shaped upland are lofty cliffs, indicating former sea action with marked clearness; and still lower than this, at the present sea level, the waves are engaged in the formation of similar cliffs. Where breached by the waves, the island below the upper reef rock is shown to be composed of a platform of foraminiferal limestone, with layers of basaltic lava.

The interpretation that Andrews places upon the structure of the island on the basis of these facts is that upon a submarine volcanic platform, beds of foraminiferal limestone were accumulated at a time when the depth of the water was too great for coral growth, thus raising the elevation of the platform. This was assisted partly by uplifts of the platform and partly by flows of lava, the upper ones of which are now lifted above sea level. Finally the water shallowed sufficiently for corals to grow and these built an atoll, which, with the continued elevation, was lifted until it has become dry land, and denudation has revealed something of the internal structure. This history, which has been worked out by Andrews, lends support to the Murray hypothesis for the origin of atolls, and is in harmony with the results obtained by Agassiz in the Fiji Islands.

Deserts and Glaciers of Central Asia.—Trained geographers are rare, and books of travel generally contain less matter that is important than unimportant, trivial details, often to be sure, woven into an entertaining narrative. Through most of these books the physiographer, for example, will search in vain for anything having a really important bearing upon his subject. It is, therefore, with a sense of relief and satisfaction that one seeking for new facts upon physical geography reads the pages of Dr. Sven Hedin's *Through Asia* (*Harper Bros.*, *1899*). In a few paragraphs it would be impossible to note all of his contributions to the Physical Geography of the Pamirs, the Desert of Gobi, and the mountains and plateaux of northern Tibet. Nearly every page of the two volumes would need to be abstracted in order to reach that end.

First in importance, however, is his discussion of the basins of interior drainage which he visited, notably the vast basin occupied by the great Desert of Gobi. As a mere description of a desert and desert conditions, his account of his struggle against death in the journey over a part of the eastern end of this great sand waste is probably unexcelled by anything ever written upon deserts. It will doubtless stand as a classic desert description. He tells how the sands have advanced so as to bury ancient cities, and to cause the abandonment of an important highway; and he relates many interesting things concerning the drainage of the great rivers that enter the desert, and their struggle against the ever encroaching sands.

Dr. Hedin's account of this region, important as it is, leaves the physiographer unsatisfied. Was this desert once the seat of large lakes, as our own Great Basin once was ? and has the climate changed since men lived there? He does not answer this question specifically, but his statements of fact, scattered here and there through the book, lead one to think that the answer to each question is *yes;* and, if so, there is here a physiographic problem of the utmost importance and well worthy of detailed investigation.

Dr. Hedin has made interesting studies also of some of the valley glaciers of the Pamirs, and has told us of the glaciers in other high mountains of that region. But, more important still, he has pointed out that these were once more extensive than now, thus proving this region to be in harmony with the glaciated mountainous regions of Europe and North America. But just how extensive were they? and what relation did their former extension have to the possible lakes? Here also are two unanswered questions. It is evidently a rich field for the physiographic geologist, and it is to be hoped that when Dr. Hedin returns to that region on his next journey he may make further investigations in this direction.

R. S. TARR.

NOTES ON CLIMATOLOGY.

BY

ROBERT DeC. WARD.

The Influence of Climate on Governments.—That climate exerts an influence, not only upon the habitability of the earth's surface and man's occupations, but also upon the state of society under which man lives and upon the development of civilization, has long been emphasized by students of climatology. The recent acquisition by the United States of a number of tropical islands has compelled our people as a whole to make some study of the climates of the new possessions, and of the influence which these climates are likely to have upon the occupation and government of these islands by a race from northern latitudes. Attention has been directed, as never before in this country, to the interesting and complex problem of the acclimatization of the white man in the tropics, and it is coming to be recognized that our future policy in some of these tropical islands is a question, not so much as to what we want to do, as it is a question, what will the climatic conditions allow us to do?

The climatic control of the government of colonies was clearly emphasized by Arthur Silva White, in an article entitled *British Unity* in the *Scottish Geographical Magazine* for August, 1896. The writer of this article divides British possessions outside of the British Isles into two classes: Colonies of Settlement, and Tropical Dependencies. In the former, the climatic conditions are not unlike those of England, Scotland and Ireland; the populations are built up chiefly by immigrants from the British Isles, and the political institutions are in close affinity with those of the mother-country. The Colonies of Settlement are Canada, Australia, New Zealand, and, to a modified extent, Cape Colony and Natal, all of which, except the Northern part of Australia, lie in the temperate zone. The Tropical Dependencies, on the other hand, have tropical climates: they are regions in which, as a rule, northern Europeans cannot establish permanent homes, and in which they therefore form but a small fraction of the population. The superior attainments and resources of the Europeans enable them, however, in spite of their small numbers, to act as rulers of the native populations. The Tropical Dependencies of Great Britain include India, the Crown

Colonies and Protectorates, and the islands, naval and coaling stations lying within the tropics. According to Mr. White's view, the only true British colonies are the self-governing colonies, which are really an extension of the mother-country beyond the seas. The remaining possessions, within the tropics, are merely appanages of the Empire.

Benjamin Kidd, in his admirable little book, *The Control of the Tropics*, recognizes the difficulties in the way of the acclimatization of the white man in the tropics. Tropical regions can never be true colonies. The vast majority of their inhabitants must always continue to be the natives. Mr. Kidd points out that there has never been, and there will not be, within any time with which we are concerned, good government, in the European sense, of the tropics by the natives of those regions. The development of the highest civilization has come, not in the tropics, where the conditions of life are easy, but outside of the tropics, where the climatic environment is more rigorous. The lesson of the past is, that there will be no development of the resources of the tropics under native government. The duty of the white race—the "White Man's Burden," as Kipling has poetically expressed it, is to govern the tropics as a trust for civilization, not on any local or low standards, but according to the highest standards and ideals of the high civilization which the white race represents. These standards and ideals have been developed and are nourished elsewhere than in the tropics.

Another writer who clearly recognizes the climatic control over governments, is W. Alleyne Ireland, who has made a careful study of the condition of labor in several tropical countries. Mr. Ireland, writing on this question in the *Atlantic Monthly* for December last, says that the attempt to govern the new tropical possessions of the United States on democratic principles is doomed to failure, for without forced labor, or some form of indentured labor, large industries cannot be developed in tropical lands, and forced labor means an upper, governing class, and a lower, more or less servile class. He points out also that the failure of France as a colonizing power has come largely from the fact that she has attempted to accomplish in the tropics what England has brought about only in her temperate colonies, *i. e.*, France has tried to people her tropical possessions with Frenchmen, and thus to build up true colonies. Her difficulty has been that her people will not emigrate to regions where they cannot become acclimated, and where there are no inducements for the making of permanent homes.

The most striking contribution to the subject under consideration is that by Hon. James Bryce, in the *Century* for March (British Experience in the Government of Colonies). Mr. Bryce divides the colonies of the world into three classes, temperate, subtropical and tropical. In the first of these classes, the race from the mother-land may live and thrive, may work out of doors as at home, and may bring up healthy children. Here the colonizing race now makes up, or will soon make up, the great mass of the population, and the institutions and the civilization are like those at home. In colonies of this type, such as Canada and Australia, the problem of government is easy. In the second class, the subtropical, the colonizing race may live, and may be able to maintain itself, but cannot do hard and continuous work. The population is largely or mainly made up of non-Europeans, and the manual labor is done by the native peoples, there being a sharp division between the more highly civilized, but small, upper class and the larger class of the native workers. Lastly, in the true tropical colony, such as central Africa or the Philippine Islands, the distinction between the races is even more marked than in the subtropical group. The colonizing race is very small in numbers, owing to the climatic obstacles in the way of a permanent and healthy settlement in the country, while the natives are extremely numerous and of a low grade of civilization. The government of the colonies of the subtropical and tropical groups is a difficult problem. If these colonies are to be self-governing, there may be a suffrage wide enough to embrace all, or some, of the natives, or the suffrage may be restricted to Europeans (or, we may add, to Americans). The objection to the first plan is the ignorance of the natives. The objection to the second plan is that the white men are too few. Another plan is to allow an incorporated company to rule the colony. Another is to proclaim a protectorate. And so on.

The problems that present themselves in the settlement and government of true tropical dependencies are many and complicated. Lessons drawn from experience with regions in temperate latitudes are of little use. Institutions fit for temperate colonies are, in most cases, out of the question in the widely diverse conditions of the tropics. No satisfactory solution of the questions of government of tropical possessions can be reached without a full understanding of the importance of the control exercised by climate in such cases.

ROBERT DEC. WARD.

NOTES ON OCEANOGRAPHY.

BY

WILLIAM LIBBEY.

THE PHYSIOGRAPHIC PROBLEMS OF SALINITY AND TEMPERATURE IN THE PACIFIC OCEAN.—A. LINDENKOHL, U. S. COAST AND GEODETIC SURVEY, in *Petermanns Mitteilungen, Vol. 45, p. 4.*

I.—BERING SEA.—The low surface density, 1.0241 in. in Bering Sea, is due to abundant condensation and large river flow. The author does not mention melting ice, but it should undoubtedly be included as a cause.

The high density, 1.0261, at the bottom, 3,654 metres, of the same body of water, is attributed to the under-currents from the main Pacific. This forms a contrast to what takes place in the Mediterranean, where the slight depth of the Straits of Gibraltar prevents the escape of the dense waters of that body to the Atlantic. The deep passage ways between the Aleutian Islands and Kamchatka (3,654 m. to 5,700) serve to introduce a large body of warmer and denser water into this basin.

There is a rapid decrease in the temperature of this body of water down to 100 m., then an increase down to 400 m., which becomes stationary to 800 m., and this followed by a very gradual decrease to 1.5° at a depth of 2,129 m.

This gradual decrease indicates plainly that we are not dealing with an enclosed body of water, such as (the Mediterranean or) the Gulf of Mexico, where there is no decrease beyond a given low temperature determined by the form of the basin.

The rise, even though it is small between 100 and 400 m., shows that it has some connection with the warmer currents of the N. W. Pacific, and not with the surface waters.

II.—SEA OF OKHOTSK.—The greatest depth of this sea is 3,370 m. (Lat. 47° 80′ and 149° 42′ W. Lon.) near the chain of the Kurile Islands, from which there is a gradual decrease in depth towards Sakhalin Island.

A phenomenon contrary to ordinary experience is noticed in a body of water from the 50th to the 200th metre-line in depth, which has a temperature of less than 0° for a distance of 120 miles east of Sakhalin Island. The surface temperature over this area is from

9° to 12°. At the same time the density of the cold body is greater than that of the warm body above it. Generally high temperatures are accompanied by a high degree of salinity.

The explanation as given by the author is found in the fact that the surface of this body of water freezes over during the course of the severe winters. This takes place, however, only after the surface temperature has been reduced to —1.7°, and the whole body of water to a depth of 200 metres has then a temperature below 0°. In the process of freezing the salts are largely excluded from the upper layer, and produce an excessive amount in the lower one. In the summer, when the ice melts, it does not reabsorb these salts, and its low salinity is intensified by the addition of fresh water from the rivers, and notably, according to Makarov, from the Amur. The current from this river passes around the north point of the island, and then down its east coast.

The slight depth of the warm water in the summer time is explained by the statement that, on account of the low salinity, there is no exchange between the upper and lower layers during the process of evaporation, and that in general the absence of currents prevents a general mingling of the layers.

In the greatest depths (600–800 metres) a temperature of 2.4° was found, and since this corresponds to a depth of 1,500 metres in the open ocean, we can take it for granted that this depth is not exceeded in any of the straits between the Kurile Islands.

The density of the water of this sea increases constantly with the depth to 1.02254. Here again it is seen that temperature and density increments come from the side and not from the surface of the water, and the question arises whence does this body receive these additions, from the main Pacific Ocean or the Japan Sea? Makarov seems to think that the source is to be found in the Japan Sea, but the facts do not seem to point to an exchange of waters at this point, but rather to a conflict. On account of the depths between the Kurile Islands less difficulties are placed in the way of an exchange than we find in the Strait of La Perouse. That the exchange does not take place from the main ocean may be due to the slight differences in the physical characters of the two bodies of water.

The work of Moser in 1896 reinforces the conclusions of Makarov, that the main source of supply is to be found in the Sea of Japan. The warmer and denser water after leaving the Strait of La Perouse turns eastward, and at about 50° N. Lat. disappears from the surface, being gradually overflowed by the colder water.

Temperature observations on the east of the Kurile Islands go to show that no warm currents reach these coasts, and the barrier presented by this chain of islands to the free passage of the tides prevents a mixture of the surface layers, and consequently depresses the temperature of the surface.

III.—Central Pacific Ocean.—Mr. Lindenkohl constructs a diagram giving a section of the Pacific, east of the Hawaiian Islands, as based upon the *Challenger* observations in 1875 between 20° 38′ N. and 13° 28′ S. Lat. The profile shows, what has generally been accepted as the case, that the southern Pacific is warmer, as well as more dense, than the northern. This is probably due to the non-existence of any single great current.

The maximum density (1.0276) in the southern Pacific is found at about 20° S. Lat. near the Society Islands. In general a decrease in density (1.0254–1.0257) is noticed to a depth of 550 metres, and then an increase towards the bottom, where the density is 1.0259. This depth (550 m.) would seem to indicate the limit of the introduction of salts and warmth from the surface, due to evaporation, etc.

There is another cause, however, which produces vertical motion in a body of water and consequently redistributes both of these elements of salt and warmth. Two bodies of water, of different degrees of salinity, can only be in equilibrium when the more saline has a higher temperature. When two such bodies come into contact and an exchange begins, the warmer shows a tendency to sink, and the colder to rise. We find, in fact, that the water of the south Pacific, with a density of from 1.0259 to 1.0260, which nowhere attains the depth of 370 metres, sinks to a depth of 1,500 metres, in the neighborhood of the Equator. On the other hand, at 20° N. Lat., on the northern border of the equatorial current, at a depth of 1,500 metres, water with a density of 1.0254 is found rising obliquely towards the Equator. At 3° N. Lat. with a density increased to 1.0258 it comes within 100 metres of the surface, where it has the effect of reducing the density of the surface to 1.0260.

A consequence of the sinking of this denser water near the Equator, is that at that point and to about 10° N. Lat. higher temperatures are found at all depths beyond 300 metres than at any position further north or south.

The rise of less saline water causes a reduction of the temperature of the water directly under the Equator

A similar series of phenomena culminating at the surface at about 10° N. Lat. is also to be noticed on the diagram.

Horizontal currents, both surface and at certain depths, and in different directions, make the problem more complex, and make the facts as given by the diagrams appear contradictory, but their explanation becomes easy when the conditions are taken into account.

PRELIMINARY REPORT UPON THE PHYSICAL INVESTIGATIONS MADE IN THE RED SEA. BY JOSEPH LUKSCH. (*Sitzungsberichte der Wiener Akademie der Wissenschaften, 1898, Vol. CVII, Abth. I, p. 609.*) *Reviewed in Naturwissenschaftliche Rundschau 1899, Vol. XIV, p. 25.*

The Austrian Expedition on the *Pola* to the Red Sea under the command of Paul von Pott, with a staff of scientific co-workers, appears to have done a considerable amount of work.

The isobathic line of 200 metres lies very close to the mainland, where the shallow shore waters are separated from the deep water by a narrow coral zone—beyond which the depth increases rapidly. The deepest portion was found to be 2,176 metres, at 20° 2′ N. Lat. and 38° 20′ E. Long.

There is an interesting section upon the coral reef region.

The results of the elaborate series of temperature and density observations may be summarized as follows:

(1) The general temperature of the sea (with due allowance for the season) is relatively high, sometimes higher than in the northern portion of the Red Sea. The specific gravity is, however, as a rule, lower.

(2) The temperature and specific gravity decrease from the surface towards the bottom. From the 700-metre line downward there is no appreciable change in the temperature, and the thermometer remains at 21.5° C. (70.7° Fahr.) from this point to the bottom.

(3) The waters on the Arabian Coast are warmer and more saline than those on the African side.

(4) On both coasts the temperatures increase from north to south, while the densities decrease.

(5) A daily variation in temperature was perceptible to a depth of 100 metres.

(6) The highest temperatures observed were 32.5° C. (90.5° Fahr.) on the surface, and 31.8° C. (89.24° Fahr.) at the bottom in 10 metres of water.

The lowest temperatures were 23° C. (73.4° Fahr.) on the surface, and 22.8° C. (73.04° Fahr.) at a depth of 14 metres.

The highest specific gravity was 1.03115, representing 4.08 per cent. salt.

Many observations were made upon the transparency and color of the water, by photographic methods and by the lowering of white plates. While the transparency of the northern portion was found to be less than that of the Mediterranean, this relation was found to be progressively greater to the south. The greatest visible depth in the northern basin was found to be 50 metres, whereas in the southern a depth of 39 metres was attained but once, and the general depth was 30, 20 or 10 metres. According to the Forel color scale the numbers 1 and 2 (99 and 98 blue, and 1 and 2 yellow) were wanting, while No. 10 (70 blue and 30 yellow) was obtained. In the northern basin the numbers 6 and 10 were never found.

How far the local conditions were modified by the meteorological phenomena has not been determined as yet. The currents, as far as they could be determined by the temperature and density relations, correspond with those of the northern basin. There was little opportunity for the measurement of waves, but in general it was noticed that the movement of the water became established quickly in deep water, whereas it was very irregular in the coral regions.

INSTRUMENTS.—The older forms of sounding tubes have often been found defective, and for a variety of reasons.

1. They were not always air-tight, and by the escape of the air gave indications of depths which were too great. Minute cracks in the sealing substance, not appreciable to the naked eye, could only be detected by using the tubes in known depths, or subjecting them to pressure.
2. Inequalities of calibration also have given rise to errors. Where the lumen of the upper end of the tube was larger than that at the lower end, the depths obtained were too great, and *vice versa*.
3. The admission of moist air of low density to the tubes further gave rise to errors when these instruments were used in water of still lower density, such as is to be found in the mouths of rivers, etc.

New tubes have been constructed by R. Füss, which have been

hermetically sealed at both ends. This insures their being air-tight for sounding purposes, and prevents the admission of air during storage. The smaller portion of the tube is taken for its upper end, which secures a safe margin of error—if there must be one—in the depth, as it is better to have the recorded depth too small than too great. This error is, however, not allowed to exceed five per cent. A short piece is broken off from the end of the tube when it is to be used. Tests of both new and old instruments have been made by the German Marine Office, which show that these new instruments are much more reliable than the old ones, giving depths in every instance to within a half metre whereas the old ones varied considerably.

Note.—It has also been found that results obtained are most reliable when the barometer stands between 730.24 mm. and 749.29 mm. (28.75 in. and 29.50 in.), otherwise a correction must be applied—*i. e.*, one fathom should be added to all depths when the barometer reads higher than given above.

(*Annalen der Hydrographie und Maritimen Meteorologie, Vol. 27, p. 50.*)

EXPEDITION OF THE *Valdivia* UNDER PROF. CHUN.—Abstract of a letter published in the *Vossische Zeitung*, Jan. 1. Notice in *Naturwissenschaftliche Rundschau, Vol. XIV., p. 38.*

After a description of the trip to Ambas Bay, the mouth of the Congo, etc., the main portion of the letter which is of importance relates to the trip from this point southward. In this region the deep-sea net gave evidence of a bottom consisting of blue-grey or black mud, with a very scanty fauna.

On October 17th, however, at 25° 26′ S. Lat. and 6° 12′ E. Long., the conditions changed very decidedly. Previous expeditions in this region had reported considerable depths, and an "intermediate" net was let out at a depth of 2,000 metres, which, however, touched the bottom. When the trawl net was lowered, an unprecedented catch was secured of the most interesting forms. This is generally the case with all such elevations or "banks" in the oceans. The variety of forms of life was very exceptional both as to number and quality. Many new species were secured, and many animals heretofore considered surface forms were found to have representatives in deep water.

In Fish Bay only the economic species were carefully studied. The abundance of the fish useful in commerce is very noteworthy in this locality. Their numbers can probably be accounted for by the richness of the colder waters in organic life. The abundance

of fish further determines the great number of birds to be found here, only comparable with our northern regions.

After their arrival in Cape Town, a ten days' trip was made to the Agulhas Bank. A preliminary report was made of work upon this bank, in which much is made of the difficulties encountered on account of the rocky character of the bottom.

The previous expeditions of the *Challenger* and the *Gazelle* located this bank at the point of contact of the Indian, Atlantic and Sub-Antarctic currents, and assigned it a special position in its relations to the distribution of animals. It was, therefore, interesting to note, among the finds of this expedition, forms directly related to northern species, among the strange new ones.

The material collected at this point by the *Valdivia* Expedition, coming from all depths, will be of great value to biologists in a number of different directions.

According to the *Geographical Journal, Vol. XIII., 1899, p. 297*, the soundings of the *Valdivia* expedition will be of especial value in filling gaps in the charts.

In the neighborhood of Enderby Island, dredgings were made in 2,541 fathoms, which brought up a number of stones, which were not of volcanic origin. The depth of this part of the Antarctic basin is particularly striking, being much greater than was supposed.

An island in 54° 26′ S. Lat. and 3° 24′ E. Long. was approached. It is doubtful whether it was Bouvet, Lindsay, or Thompson Island. It appears to be a volcanic crater, covered with a glacial cap.

SUB-OCEANIC PHYSICAL FEATURES OF THE COAST OF WESTERN EUROPE. PROF. HULL, *Geographical Journal, Vol. XIII, No. 3 (1899), p. 285.*—Based upon the fact that the 100-fathom platform of northern Europe is the submarine foundation from which the British Isles rise, Prof. Hull has read a paper before the Royal Geographical Society upon the subject of the physical features of this platform. The paper certainly had the merit of provoking discussion. It sought to show that this platform was traversed by ancient river valleys, which were inferentially traceable to the rivers which drain the adjacent lands at the present time.

The paper is a continuation of the discussion of the same subject by Prof. Hull in the *Journal of the Victoria Institute, Vol. XXX, p. 305.*

The proofs adduced in evidence of the channels being river beds are as follows:

1. A continuous deepening of the channel in the direction of the outlet.

2. Continuous widening of the channel in the same direction.
3. A winding course, unlike that of faults or fissures.
4. Lateral branches descending from adjoining land on either hand.

The continuity of the ancient channels with those of existing rivers is most clearly seen in the cases of the Adour and Tagus, though many others were traced off the coasts of England, France, Spain and Portugal.

The paper was followed by a very able and thoroughly interesting discussion, which reminds one of the storm that greeted the first announcement that the Colorado Cañon and some other portions of our own continent were due to sub-aerial erosion. The strongest among those who opposed the interpretations of Prof. Hull urged caution as to the hasty adoption of theories upon a slender basis of fact. More actual soundings are needed before such results can rest upon a secure basis.

That such cuts do exist on our side of the water is hardly to be doubted, but whether they have not been assisted by the fracture of the earth's crust, still remains to be proved. An illustration might be found bearing on this point in the sub-marine extension of the Hudson River channel to the edge of the continental platform. Such cuts, if they exist, must have been produced by subaerial erosion and they have their splendid counterparts in our southwestern territory. But the consequences from a geological point of view would be interesting, such as the elevation of the whole English Channel area through a distance of 6,000 feet, even if there seems to be good reason for it when comparisons are made with other areas, as was shown by Prof. Hull in his reply to his critics.

W. L.

RECORD OF GEOGRAPHICAL PROGRESS.

SOUTH AMERICA.

Immigration in South America.—Only about 10,000 foreigners have made new homes in Colombia where a rural population, twenty times as large as it is to-day, might live in comfort on healthful and productive plains high above sea-level. In Ecuador there is a German colony near the source of the Rio Toachi among the Cordilleras and a few colonists have settled in Guayaquil. Ecuador cannot be attractive to foreigners until wagon roads replace the bridle-paths that are now impassable for half the year. Less than 1,000 Europeans and Americans are settled in Bolivia. About one-sixth of the population of Lima, Peru, are immigrants from Europe and Peru's foreign population numbers about 25,000. In Lima the Italians are prominent in the retail trade and some of the largest wholesale merchants are English and German. Considerable American capital is invested in the mines, in shipping, and in agriculture. Chile grows in population more rapidly than any other Andean region. No districts can be called densely peopled except the provinces around Valparaiso and Santiago. There are about 100,000 foreigners in the country, but the annual immigration is small, though encouraged by the Government. The Italians in recent years have headed the list of incomers. Colonies, chiefly Germans and Swiss, have settled in the southern provinces. The mining industries of the north and the manufacturing and trading opportunities at Santiago and a few other centres have especially attracted immigration. Over 1,000,000 foreigners have made new homes in Argentina and a third of them live in the city of Buenos Aires. The population of Argentina has more than doubled in twenty-six years, which is commensurate with the rapid growth of our country in the most flourishing period of immigration. Paraguay pays the passage of immigrants from Buenos Aires and advances oxen and farming tools to be paid for on easy terms. As yet, however, that Republic is attracting very few immigrants. It is a rich land, as large as Italy, with only one-tenth of the population of that kingdom, and now that stable government has succeeded the days of revolution there is no reason why considerable development should not be attained. The labor problem is of great importance in Brazil and the Government has long endeavored to solve it by

promoting immigration. The most successful colonies have been planted in the southern states of Paraná, Santa Catharina, Rio Grande do Sul and São Paulo. About 50,000 Poles, Austrians and Italians are settled in the ninety-three centres of colonization in Paraná. German influence predominates in Santa Catharina, where about 50,000 persons of that nationality are engaged chiefly in agriculture. The colonists in Rio Grande do Sul number 108,000 and over 1,000,000 immigrants have entered Brazil since 1871. About 100.000 immigrants have been attracted to the pastoral country of Uruguay in eighteen years, but labor is still scarce, for with growing population more lands are taken up. Venezuela made a contract last fall by which it is expected to bring many Italian farmers to the country. These facts show that the southern Republics are gradually gaining the population they need to develop their resources.

THE CHILE-ARGENTINA DISPUTE.—Early in February, Lord Salisbury appointed a Commission to settle the boundary dispute between Argentina and Chile, both nations having agreed to abide by its decision. Some of the questions involved have already been passed upon, neither country receiving its full claims. One result of the dispute has given much satisfaction to geographers. Mountain exploration has been extensively carried on in the disputed region by both countries for the past seven years. The result is that much of the Andean region between Cape Horn and the 39th parallel has been revealed by surveys that have contributed much information for the maps. So much light has been thrown on the geography of this region that events there to-day cannot be followed on the best map-sheets of South America published five years ago. Dr. Polakowsky recently said that four or five years more of similar labors would make the physical geography of this intricate mountain region completely known. This boundary dispute illustrates the perils of treaty agreements whose language may be variously construed, and the fatuity of naming a natural boundary between nations, such as a mountain range, when the parties making the contract know little or nothing of the geography of the region. The boundary treaty of 1881 said that "the boundary line shall pass over the highest summits of the Andes which form the water shed." Confusion resulted when it was found that the high mountains do not form the water parting. Rivers rising to the east of the main Andes find their way west through the valleys of the giant ranges and empty into the Pacific. The wording of the treaty did not accord with the facts, and hence, the chance for misunderstanding.

Meanwhile Argentine colonists and Chilian settlers made new homes in fertile valleys that were claimed both by Chile and Argentina. The incessant friction due to the boundary dispute more than once strained the relations of the two countries to the danger point, and therefore it was wisely decided to refer the whole matter to an impartial tribunal for final settlement.

EUROPE.

FIGHTING THE SEA ON THE SCHLESWIG COAST.—A large appropriation was made last year by the Prussian legislature for the protection of the low, west coast of Schleswig and the neighboring islands against the invasion of the North Sea. A force is now building a break-water between the little island of Oland and the mainland which, in connection with other works already completed, is expected to keep the sea within bounds for many miles. The people expect to acquire new lands that will be reclaimed from the sea by the dikes building around them. A special feature of the new works is the complete protection they are intended to give to the low-lying Halligen islands which rise only a few feet above high water. Their inhabitants have been driven by the encroachments of the sea to live in small cabins built on artificial mounds and many have abandoned their homes and sought refuge on the mainland. Since the Middle Ages, the sea has gnawed away the entire west coast to a depth of over twenty miles and the islands are now merely the ruins of what was solid land. In 600 years Schleswig has thus lost one-third of its area.

AFRICA.

THE NEW ANGLO-FRENCH AGREEMENT.—Lord Salisbury and M. Paul Cambon, the French Ambassador to Great Britain, signed at London on March 21, an agreement regarding the delimitation of the respective spheres of Great Britain and France in Central Africa, thus ending their recent misunderstanding with regard to the Nile. The London *Times* of March 23, reports that from the northern

frontier of the Belgian Congo to the 15th degree of latitude the delimitation will be carried out by a mixed commission, it being understood in principle that Great Britain retains the Bahr-el-Ghazal and Darfur, while France keeps Wadai and Bagirmi, likewise Kanem, and, generally speaking, the territory to the east and north of Lake Chad. North of the 15th degree of latitude, Great Britain recognizes that the French sphere extends south of the Tropic of Cancer as far as the line which, broadly speaking, coincides with the western limit of the Libyan Desert. From the Nile to Lake Chad and between the 5th and 15th parallels the two Powers mutually concede equality of treatment in commercial matters. This clause will thus permit France to have commercial establishments on the Nile and its affluents. Finally, the two Powers mutually undertake to refrain from exercising political or territorial rights outside of the frontiers fixed by the arrangement.

Foureau's Latest Expedition in the Sahara.—A false report was circulated late in March that Mr. F. Foureau, the well-known explorer of the Sahara, had been attacked by Tuaregs in the eastern Erg, one of the great sand expanses south of Algeria, and that about 100 men of his party had been killed. The fact is, that the explorer with a large expedition arrived safely at Agades in the southern part of the Sahara early this year. He has with him 180 Algerian soldiers under the orders of Commander Lamy and five other officers. The entire personnel numbers about 200 men, and 1,000 camels carry their equipment. The French Government fitted out the expedition, and its purpose is to explore the oases of the desert and the parts of the Sudan which under the treaties with Great Britain and Germany, signed between 1891 and 1894, fell to the share of France. The explorer has instructions not to enter any territories belonging to other Powers. This is Foureau's tenth expedition. Hitherto his explorations have been carried on with the financial support only of private citizens and scientific societies, but in spite of his slender resources he has greatly improved the mapping of that part of the Sahara lying south of Algeria, and France has used the information he obtained to extend her military posts further south.

The Cairo-Cape Town Railroad.—Mr. Cecil Rhodes has met with so much encouragement, both in London and Berlin, for his scheme to connect Cape Town with Cairo by a line of railroad 5,644 miles long, that there is little doubt that the enterprise will be carried out. The existing north and south railroads along the route are to form a part of the line, and 2,334 miles of the railroad are now in operation. In other words, the gap to be filled between the railroad now pushing south along the Nile to Omdurman and the completed line from Cape Town to Buluwayo is 3,330 miles. About two-fifths of the continental railroad is therefore in operation. The British Government has also sanctioned the extension of the Omdurman line to the Sobat River, 480 miles further south, and the line to Buluwayo is to be pushed north to the Zambezi River as rapidly as possible. The completion of about half of the proposed railroad was therefore assured before Mr. Rhodes recently unfolded his plans in London. It is seen from his railroad map published in the London *Daily Mail* that he proposes to extend the line northward to the coal discoveries of the middle Zambezi, and to the coal and iron district of the British Central African Protectorate further north, pass to the east of Lake Bangweolo, and

make straight for the south end of Tanganyika. He has arranged with the German Government for building the road 700 miles through German East Africa. Navigation on the lake, however, is free, and steamers may for a time form the connecting link between the railroad lines at the north and south ends of the lake. North of Tanganyika the route passes to the east of lakes Kivu, Albert Edward, and Albert, and then follows the Nile to the Mediterranean, only leaving the river to cut off the big bends at the Sobat and Abu Hamed. Mr. Rhodes's theory is that while the earnings of the road will be necessarily small for the first ten years, still the resources of the country are very great, and the line cannot fail to be a financial success if its existence be assured during the first critical years. Mr. Rhodes expects to complete a telegraph line from Cape Town to the Mediterranean long before the Transcontinental railroad is in operation. Like the railroad, it will also connect with the north and south lines, and the company, already organized, expects to string only about 2,700 miles of wire to connect Cape Town and Alexandria. The chief stations along the line will be Buluwayo and Salisbury in Rhodesia, Tete on the Zambezi, Blantyre, capital of Nyassaland, Karonga, at the north end of Lake Nyassa, three posts on Tanganyika, Fort George on Lake Albert Edward, and two stations on Albert Nyanza, whence the line will follow the Nile to Alexandria.

Death of Explorer Mizon.—Lieut. Mizon, of the French Navy, died at Mayotti, March 22, while on his way to take the governorship of the Obock Colony on the Gulf of Aden. He will be remembered for his journey in 1890–92, when, after reaching Yola, the capital of Adamawa, on the Benue River, and vainly seeking permission to go on to Lake Chad, he turned southward through wholly unknown regions, where his discoveries and the treaties he made with native chiefs were eventually a part of the bases for the extension of the French Congo to the north-east as far as Lake Chad. He crossed the water-parting between the Niger and Congo, and followed from source to mouth the almost unknown Sanga River, which is shown to be 1,000 miles long and the fourth largest tributary of the Congo. France, a little later, planted a line of stations along the Sanga. About the same time, Dybowski fixed the water-parting between the Nile and Congo basins still further east, and these determinations, together with the work of Belgian explorers, showed that the domain of the Congo River extends further north

than had been supposed, though it cannot be said that the boundary between the basins is yet accurately defined.

TRAVELS OF THE JIGGER.—*Petermanns Mitteilungen* says that the jigger, one of the insect pests of the West Indies and South America, has at last crossed Equatorial Africa from the Atlantic to the Indian Ocean, about 2,700 miles, twenty-six years after its arrival in Africa. It is a variety of the flea, much smaller than the common flea, and its attacks upon a few animals, including man, if not treated in time, are sometimes fatal to life. The sand ballast from a Brazilian sailing vessel was dumped on the beach at Ambriz, Angola, in September, 1872. The insect was brought from Brazil in this ballast. It was thirteen years penetrating 300 miles into Africa. Arriving at Stanley Pool its progress eastward was more rapid. Dr. Oscar Baumann reported it in 1892 at Bukumbi Gulf, on the south coast of Victoria Nyanza. In 1895 it had reached Mpwapwa, among the mountains 200 miles from the Indian Ocean. Late in 1897 it appeared along 70 miles of the coast opposite Zanzibar, and last year appeared on Zanzibar Island. It has a propensity for boring through the skin and lodging between the cuticle and the flesh. On its journey across Africa the natives suffered greatly from the pest, and often abandoned their villages in consternation. Rubbing the skin with tobacco leaves and, above all, cleanliness and the wearing of shoes are said to be effective protection against the jigger.

ASIA.

DR. SVEN HEDIN GOING TO TIBET.—*Petermanns Mitteilungen* says that Dr. Sven Hedin will return to Central Asia this spring. As soon as he completed the records of the scientific results of his last journey he began preparations for his coming work. His starting point will be Kashgar, in Chinese Turkestan; and he will again cross, by a different route, the Takla-Makan desert, and then will make his way to northern Tibet, where he expects to spend next winter. In the summer of 1900 he expects to cross this loftiest plateau in the world from north to south, emerging in India.

JEWISH IMMIGRATION INTO PALESTINE PROHIBITED.—Turkey's enactment, several years ago, forbidding the entrance of foreign Jews into Palestine, has not hitherto been rigidly enforced, and a considerable number of Hebrews from other lands have every year sought new homes in their fatherland. In December last, the Turkish legation at Washington notified the State Department that foreign Jews are forbidden to enter Palestine, and that the authori-

ties had received orders to prevent them from landing. About 22,000 Jews now live in Jerusalem, of whom one-half came from Europe and America. About 5,000 immigrants live in twenty-two farming communities founded by Baron Edmond de Rothschild and by colonization societies. The total Hebrew population is about 40,000, of whom 16,000 are foreigners. The Jews are heavily taxed, and complain that the officials are overbearing and tyrannical. Last fall, one of the colonies on the caravan route from Damascus to Mecca was driven from its home by predatory Arabs. A road which the Hebrew colonists built between two of their settlements was recently destroyed. Most of the farming colonies, however, are fairly prosperous; live chiefly by fruit and raw silk culture, and maintain schools and synagogues. It may be that the prohibition of immigration will not long be enforced, for foreign influences are getting a strong foothold in Palestine. Railroads now operating between Beirut and Damascus, and between Jaffa and Jerusalem, are affecting the whole region favorably. Another railroad is now building from Haifa through Galilee to Damascus, and it will probably be extended to Bagdad. Foreign capitalists have secured valuable railroad, harbor and other franchises, which will favorably influence the development of the country.

AUSTRALASIA.

FOUR HUNDRED PEARL-SHELL FISHERMEN DROWNED OFF NORTH-EAST QUEENSLAND.—A hurricane in the first week of March destroyed about 100 boats and drowned 400 pearl-shell fishers, about half the entire fleet engaged in this industry of Queensland. Most of the men were colored of various nationalities, including aborigines living near the fisheries, South Sea islanders and Manila, Chinese, Japanese and Malay divers. The greatest peril encountered in this business is the sudden hurricanes which visit the Queensland coast. For years the product of these fisheries has fluctuated between the sixth and the eighth place in the list of Queensland's exports. The shell is now pretty well worked out in the shallow waters, and the native divers are not so much employed as they formerly were, for they cannot work with success beyond a depth of sixty feet. Most of the shell is obtained only by men wearing the diving dress. One hundred and twenty feet is the greatest depth from which the shell is profitably taken and few divers can stand the strain of prolonged work under the pressure at that depth. The quest for pearls is merely incidental to these fisheries, which are carried on for shell or mother-of-pearl. On an average about

4,000 shells are taken for every pearl found. The pearls of the Queensland region are of fine size and quality, but not one shell in thousands produces a perfect specimen.

Rabbit Fences in New South Wales.—The last annual report of the Department of Lands, New South Wales, has a note on the progress of the colonial Government in its efforts to cope with the rabbit pest by the erection of fences that are said to be rabbit-proof, the animal not being able to get over, under or through it. The first fence was built in 1897, and the number of miles of fencing is now 17,280. The fence has been extended along the entire western border of the colony and along two-thirds of the northern boundary. This little animal was imported from the British islands and has multiplied on so enormous a scale that it has actually endangered the existence of other grass-eating animals. Some years ago, the Government of New South Wales offered a reward of $125,000 for a feasible method of exterminating the pest. Eighteen hundred schemes were submitted, but none of them proved practicable.

POLAR REGIONS.

The search for Andree and his companions will not be given up, while a gleam of hope remains. Prof. Nathorst, who is to set out in June in a steam-whaler, will try to break through the ice-barrier on the eastern coast of Greenland, if possible in the neighborhood of Cape Bismarck, and thence push to the north in sledge or boat.

He thinks it just possible that Andree may have found his way to north Greenland and been able to keep himself alive on the food resources of the region, in musk oxen, seals and the like; and every effort will be made to follow any trace, however slight.

The expedition seems to be assured by the offer of the steam-whaler *Hekla*, made by Mr. Hammer, a merchant of Christiania. (*Petermanns Mitteilungen*, *45 Band*, *II.*)

The *Geographical Journal*, for April, prints the following letter from Mr. L. W. Longstaff to the President of the Royal Geographical Society:

Dear Sir Clements Markham:

Being convinced of the imperative need of the immediate preparation of a British expedition, I have the pleasure to inform you that I have this day paid to the credit of the National Antarctic Expedition with Messrs. Cocks, Biddulph & Co. the sum of £25,000, which I trust will meet the exigency of the case.

Though my attainments are but slight, I have all my life been much interested in scientific matters, and as a Fellow of our Society for nearly thirty years, it gives me

peculiar pleasure to be able thus to contribute towards the advancement of our knowledge of the planet on which we live.

I am, dear Sir Clements,

Yours faithfully,

RIDGELANDS, LLEWELLYN W. LONGSTAFF.

Wimbledon, March 22, 1899.

This generous gift puts an end to the uncertainty with regard to a British Antarctic Expedition. The summer of 1900 will be marked by the dispatch of this and the German Expedition under Drygalski, with the same general plan of work and pledged to co-operation with each other. The plan, as submitted by the Germans and accepted by the British, is to winter on Victoria Land; to set out, in the spring of 1901, on sledges towards the South Pole, to fix the location of the south magnetic pole and to carry out a thorough exploration in every branch of science. The work will be continued for two years.

A note in *Petermanns Mitteilungen, 45 Band, III*, postpones the departure of the German expedition to August, 1901.

The Brooklyn *Standard-Union*, of April 4, printed the following telegram:

MONTE VIDEO, S. A., April 4.

The "Belgica" arrived here this morning. All well. Our Antarctic voyage has been a complete success. Much new land in Weddell Sea and open water to the far south discovered. Active volcanos were also seen. I come home direct by early steamer. The "Belgica" will not return for another winter, as originally planned. We lost men by accident, but none by disease. COOK.

Dr. F. A. Cook, of Brooklyn, was the surgeon of the Belgian Antarctic Expedition in the *Belgica*, under the command of Lieut. A. de Gerlache.

The telegram brings the first news of the expedition for many months since a letter from Ushuaia, on Tierra del Fuego, dated Dec. 30, 1897, announced the intended departure of the steamer the next day for the south.

NOTES ON ANTHROPOLOGY.

BY

ROLAND B. DIXON.

POPULATION AND ENVIRONMENT IN WESTERN MASSACHUSETTS. (*Continued.*)—Contrasting the Upland with the Lowland as regards the relative proportion of the sexes, it appears that in 1895 the population of the Upland was composed of 51.13% males and 48.87% females, while in the Lowlands the proportions were 48.58% males to 51.42% females;—the males being in excess in the Upland and the females in the Lowland. That this is not a temporary condition is shown by the fact that much the same proportions existed in 1875, when the figures were for the Upland 50.89% males to 49.11% females, and for the Lowland 46.15% males and 53.85% females. This preponderance of males in the Upland and females in the Lowland may be traced as far back as 1855, but earlier than this the two regions are, as regards the proportions of the sexes, nearly equal. If instead of dealing with aggregates we consider individual towns, the contrast between Upland and Lowland is, as in the cases of the growth of population, even more striking. Among the Upland towns it is very seldom that we find one in which there is an excess of females, and when such a case occurs it is almost without exception in a town in which the greater part of the population live in the deep valleys by which the Upland is trenched. In the Lowland towns there is more variation, a strong preponderance of males being noticeable in several cases.

The explanation of this state of affairs is, it seems, to be found in the fact that the population of the Upland is of necessity prevailingly agricultural in its pursuits, while the Lowland is manufacturing. In the Upland nearly 25% of the population is engaged in agriculture, and only about 6% in manufacturing; in the Lowland, on the other hand, only 12% are occupied in agricultural pursuits while 14% are employed in manufactures. Agriculture is normally carried on by men to the exclusion of women, whereas a considerable part of the labor in manufacturing industries is supplied by women, so that the preponderance of males in the Upland and of females in the Lowland seems explainable, at least in part, on this ground. We find in this also an explanation for the excess of females in the few Upland towns. Being valley-towns they have water-power, and hence manufacturing interests.

Of the many other ways in which the Upland and Lowland differ from each other there is much to be said, but I can here refer only briefly to some of them. In the Upland towns a greater proportion of the inhabitants are native to the towns in which they now live than is the case in the Lowland; the Upland towns exceeding the Lowland in this respect often as much as 10–15%. In other words the Upland population is much more stable than that of the Lowland, with less of the shifting element noticeable, even in the smaller Lowland towns. The same families are to be found in these Upland towns that were there a century or more ago, and they have as a result of constant intermarrying developed into what are, in every respect but name, real clans. And it is perhaps largely to this lack of infusion of new blood and to the absence of interest in the affairs of the outside world that we may trace the intellectual narrowness and conservatism which are characteristic of the Upland.

I can do no more than refer to the apparently greater proportion of older people, and to the greater frequency of large families in the Upland as opposed to the Lowland, and note in passing that in spite of the much larger proportion of the population engaged in agriculture, the percentage of land under cultivation in the Upland is on the average but half that in the Lowland.

In speaking of the various ways in which environment makes itself felt, the means of communication were referred to, and in this connection the history of the various roads in the region under consideration, is of interest. The long even-topped ridges of the Upland run with very considerable regularity NN.W. and SS.E., and the trend of a large proportion of the roads is determined by them. Roads running with the trend of the ridges offer easy grades and long stretches of comparatively level road; whereas those roads running across the line of the ridges have many bad hills and few level portions. The main lines of trade running as they do across the Upland and its ridges, have necessitated many such hilly roads, but even in these the changes are interesting. At first they ran on the lines of the old Indian trails and paid little attention to the topography, but as time went on these old roads were found too steep, and considerable parts were rebuilt more in accordance with the lay of the land. In a somewhat similar way town boundaries were first laid out with little or no regard to the surface of the region, and had later to be re-adjusted.

In this mere outline of a few of the ways in which topographic environment shows its control of population, many important de-

tails have necessarily been omitted. But it has been shown that the two areas into which the region was divided differ in many respects very considerably from each other. And these differences are not without their practical bearing. The decreasing population of the Upland area is a matter which may well attract attention. Should the present tendencies in this direction continue, and the agricultural competition of the West and South increase as well, the future of this Upland region presents numerous problems not easy of solution. The Lowland, with its ease of communication and large manufacturing interests, seems secure; but for the Upland there appears but a sorry outlook. Additional investigations along lines similar to those suggested here may, by increasing our knowledge of the limitations and tendencies of such a region, aid in devising means for its amelioration. But whether they lead to practical results along these lines or not, they will at least serve to throw some additional light on the broad questions of the interrelations between man and his environment.

THE PHILIPPINES.—In a recent paper read before the Berlin Academy (*Die Bevölkerung der Philippinen. Sitzungsberichte d. K. Preuss. Akademie der Wissenschaften zu Berlin; 19 Jan. '99 S. 14–26*), Prof. Rudolf Virchow sums up in a timely way much of our information about the islands. Of the population that portion belonging to the Negrito stock has had very little to do with the insurgent movement, practically all of which has been due to the tribes of Malayan origin. The exact position and relationship of these "Indios" is difficult to determine on account of the great amount of mixture with European and Mongolian peoples. All immigration into the islands must have been from the west, and there are strong grounds for believing that in early times there was a great emigration from the Philippines towards the east, and that by this means the Polynesian islands received their population. Referring to the differences between the various tribes in the group, Virchow declares that in spite of the considerable climatic, geologic and topographic differences between the islands, nowhere does environment seem to play so small a part in the differentiation. Heredity is here in the ascendant. The Negritos are described as very uniform in character, whereas the so-called "Indios" are exceedingly variable. Referring to the value of tattooing in determining ethnic affinities, the lack of any considerable body of information on this head is deplored, and an appeal made for the collection of material before the older customs shall have

entirely died out. The Philippines constitute one of the few regions in the Eastern Hemisphere in which deformation of the skull is common; but the custom seems to be confined almost exclusively to the Indios, the Negritos, with the possible exception of the Tinguianes of Luzon, not being known to practice it.

An Australian Implement of Unknown Use.—At various times within the last few years specimens of a curious implement, or perhaps it would be better to call it merely a curious object, have been found in the western part of New South Wales. Some eight or nine have so far been reported, and these are discussed by W. R. Harper in regard to their possible uses, in a late number of the *Proceedings of the Linnean Society of N. S. W.* (*Vol. XXIII, pp. 420–438*). The objects in question are cigar-shaped, and from ten to twenty inches or so in length. One end is pointed, whereas the other is flat, and has a cup-shaped hollow in its centre. They are made either of stone or hard clay, are ornamented with various designs scratched upon the surface, and show no traces of wear except in a narrow band about the base. Except for the cup-shaped hollow in the lower end, and the lack of all traces of grinding these objects are very similar to the "metate-stones" used by the Indians of the South-west for grinding grain. That they were used for any such purpose seems unlikely in view of the friable character of one or two of the specimens. The natives who have been questioned can give no clue as to their use. In some cases the specimens were found as much as six feet below the surface of the ground, which might indicate that they had been in use among a population older than that at present known. Considerable interest attaches to these objects, and it is to be hoped that light may be thrown on them from the examination of similar objects (if known) from other parts of the world.

Roland B. Dixon.

WASHINGTON LETTER.

WASHINGTON, D. C., APRIL 17, 1899.

TWELFTH CENSUS OF THE UNITED STATES.—Under the provisions of an act approved March 3, 1899, there has been created in the Department of the Interior a bureau known as the Census Office, charged with taking the twelfth census of the United States, that for the year 1900. The official in charge is known as the "Director" and not as the "Superintendent," as in the case of former organizations. The President has already appointed Ex-Gov. W. R. Merriam, of Minnesota, a man of recognized executive ability and of broad capacity. As Assistant Director Dr. Fred H. Wines has been designated. Dr. Wines was connected with the Tenth and Eleventh Censuses, and prepared the volumes upon crime, pauperism and benevolence. The office has been fortunate in securing the continued service of Mr. Henry Gannett, Geographer of the Tenth and Eleventh Censuses, and for many years principal scientist of the Geological Survey in the branch having to do with geography and allied subjects. Provision has been made for five chief statisticians who are required to be of known and tried experience. Each of these chief statisticians is to have charge of particular branches or divisions of the work. For the agricultural division Mr. LeGrand Powers, of Minnesota, has been designated. Mr. Powers was for a number of years chief of the Bureau of Labor of Minnesota, and was prominently identified with much of the successful legislation of that State on regulating child labor, authorizing factory inspection, and resulting in other beneficial acts. He has taken a broad, scholarly view of social and economic topics, and has particular interest in discussions of the resources of the country as bearing upon the great industrial problems. Another of the chief statisticians is Mr. W. C. Hunt, who, as special expert agent of the Eleventh Census, prepared the volumes upon population. Mr. William A. King has also been designated, he having been for many years in charge of that division of the office of the Secretary of the Interior having to do with the completion of minor matters connected with the Eleventh Census and the storing of the records.

One of the most noteworthy appointments is that of Mr. Walter F. Willcox, Professor of Social Science and Statistics of Cornell University. It is understood that Professor Willcox will ultimately devote his attention largely to the discussion of results and the presentation of these in form most useful to the scientific world and to

the public who have to do with such matters. There has been in the past some criticism to the effect that the census returns have not been sufficiently explicit nor convenient for reference, and on the part of specialists complaints that one topic or another has not been properly considered. It is to be hoped that in the making of the Twelfth Census these specialists will be brought into close touch with the practical operations of securing the desired information, so that they may be better able to judge for themselves, not only the value of the results but the futility of demanding returns which in the nature of the case can not be had. The greater part of the work of the census is mechanical in nature, and requires for completion the exercise of a high order of business ability, but beyond or beneath this it is essential that full consideration be had of the ends toward which work should be directed. It is suggested that by the employment or co-operation of professors or colleges, and of men having to do with the social problems, it will be possible to reach a higher degree of completion in the Twelfth Census than in preceding investigations of this character.

The law provides that there shall be not to exceed 300 Supervisors' Districts, and advises that, as far as practicable, these coincide with Congressional Districts. As there are 357 of these latter it is evident that changes must be made. The principal consolidations are in cases of large cities or densely settled portions of the country. For example, Manhattan and Bronx boroughs make one Supervisor's District, and Richmond, Brooklyn, and Queens boroughs, together with Nassau and Suffolk counties, make another district. The city of Philadelphia is included within one district, and also Cook County, embracing the city of Chicago. This is the case with Erie County, including the city of Buffalo, and the entire city of St. Louis and also of Baltimore. Other consolidations of Congressional Districts into one Supervisor's District are in the New England States, where Massachusetts, New Hampshire, Vermont, Rhode Island and Connecticut, each, form a single Supervisor's District. Each of the 300 supervisors is to be appointed by the President and confirmed by the Senate. Thus it is apparent that in most cases not only will the representative in Congress have a voice in the appointment of the supervisors, but the senators must also be consulted and the applicant in turn must be acceptable to the Director of the Census and to the President.

Each minor political division, such as a rural county or town, city ward or precinct, constitutes an Enumerator's District, the subdivision being so drawn that no enumerator shall have the count-

ing of over 4,000 individuals. The enumerators to be appointed by the Director upon nomination by the supervisors are to be, as far as practicable, residents of the minor divisions whose population they are required to count. The supervisor is to submit to the Director of the Census, together with names of the nominees, certain evidence as to the fitness of the person, this being mainly in the form of practice sheets prepared as tests for qualification for the work. The enumeration of the people, to be begun in June, 1900, must be completed for the cities within two weeks and for the country within thirty days. An army of over 30,000 men will thus be created and disbanded after one month's operations.

The enumerators' returns are to be forwarded by the supervisors to Washington and there placed in the hands of a thousand clerks who will transfer the results to small cards, there being one of these for each person enumerated. These cards are punched with from 20 to 40 holes out of the possible number of 240. The arrangement of these holes indicates the age, sex, color, nativity, conjugal condition, and other items. It is estimated that an average of 700 cards can be punched each day by one clerk, or 700,000 by the entire force, necessitating 100 working days for preparing all the cards. These 70 million or more cards after being checked will be fed to about 150 electrical machines provided with dials from which the totals can be read. These readings when assembled go to the printer and the results are then ready for the public.

The enumeration, to be begun in June, 1900, is to be complete within 30 days and the law requires that the volumes shall be printed within two years, necessitating the utmost efficiency and activity on the part of the administration of the office. It is believed that this result can be obtained if the plans now prepared are not defeated by action of Congress in failing to provide necessary funds, or in other ways. The operations in theory are exceedingly simple, but the enormous scale upon which they are conducted introduces many complications, such, for example, as putting into the hands of 30,000 new men a suitable supply of blanks, and later of instructing a thousand inexperienced persons in the use of the punching machines or of other devices. There will probably be upwards of 3,000 clerks employed in Washington and the providing of proper accommodations for these clerks is alone a matter of considerable difficulty.

WASHINGTON ACADEMY OF SCIENCES AND AFFILIATED SOCIETIES.—The Academy of Sciences, incorporated February 15, 1898, has entered upon its second year with the election of Hon. Charles D. Walcott, Director of the U. S. Geological Survey, as president.

Among the vice-presidents are Dr. Alexander Graham Bell, Mr. G. K. Gilbert and Mr. A. R. Spofford, of the Library of Congress. Its secretary is Dr. Frank Baker, Superintendent of the National Zoological Park. Among the managers are Dr C. Hart Merriam, in charge of the Biological Survey, Mr. H. S. Pritchett, Superintendent of the Coast and Geodetic Survey, Gen. G. M. Sternberg, Surgeon-General, U. S. Army, Maj. J. W. Powell, Director of the Bureau of American Ethnology, and Col. Carroll D. Wright, Commissioner of Labor.

The objects of the Academy are varied, and are so broadly stated in its constitution that it may be permitted to enter upon almost any undertaking toward advancing the interests of science or of the group of scientific men in Washington. Its particular function at present may be said to be that of a federal head for the affiliated societies, only members of these societies being eligible to membership. The present list includes 144 persons out of a possible total of 1,742 members of the nine affiliated organizations.

The scientific societies that have united in the support of the Washington Academy are, with their membership, as follows:

Anthropological	139
Biological	168
Chemical	115
Entomological	44
National Geographic	1,357
Geological	146
Historical	105
Medical	289
Philosophical	113

The figures given do not include, except in the case of the Chemical, the associate or corresponding members. The total of the members given is 2,476, but many of the names have been counted several times as the individuals are members of two or more of the component group; for example, there are 232 persons members of two societies; 68 who are members of three; 31 who are members of four ; and one person a member of all of the societies.

Under the leadership of Mr. Walcott it is hoped to make the Academy a living factor in the advance of science in Washington. A curious condition exists in this city, that although there is a large body of scientific men there has been of late years no distinctly representative organization capable of efficient activity on behalf of

all concerned. It is the apparent purpose of the leaders of the new Academy not to infringe upon the claims of other organizations, but rather to try to bring together into an energetic body all of the men who are working toward the advancement of knowledge. One of the first apparent results has been the issuing of a directory, showing in a single alphabetical list the names of all members of the Academy and of its nine affiliated societies. Another result is the Saturday afternoon lectures, the general subject of these being the natural and social development of the District of Columbia.

Examination of Soils.—Among the investigations or explorations of resources of geographic importance carried on by the Department of Agriculture may be included the examination of soils in various parts of the United States. This is under the Division of Soils, of which Prof. Milton Whitney is chief. Work has been planned for the coming field season for a number of localities, of which two have peculiar interest, namely, the Pecos Valley of New Mexico, and the great central valley of Utah. Mr. Thomas H. Means has been sent out to carry on this investigation, with instructions to pay particular attention to the occurrence of alkali, and to the evil effects due to its development and spread over the surface of the ground. Work of this character was conducted during 1898 in the Yellowstone Valley of Montana, and the results have been of unusual interest, because of the fact that the conditions encountered there are by no means local, but are found in greater or less degree throughout the western half of the United States.

The Yellowstone River, rising in the National Park, flows northerly, and by a series of falls, well known for their majestic beauty, passes into deep cañons, emerging finally near the point where now is the town of Livingston. From here it continues in a general course a little north of east and then northeast to meet the Missouri River at the eastern boundary of the State of Montana. The valley from Livingston easterly to the State line, following the course of the river, is approximately 400 miles in length and relatively narrow. The country is arid, and for successful agriculture the artificial application of water is necessary. Small canals and ditches have been built to bring water upon the lower lands, and it is possible that in the distant future great canals will be constructed, winding along the bluffs and finally surmounting them to carry out water from the Yellowstone to moisten the vast plains north of the river and between it and the Missouri. In spite of the fact that only a small amount of land is under cultivation, and that water has been thus used for only from 12 to 15 years, it has happened that a

considerable area of the fertile fields has been destroyed or rendered useless by the accumulation of earthy salts near the surface, preventing the growth of ordinary crops.

When the country was first settled the depth of standing water in the wells was from 20 to 50 feet beneath the surface, and there were no signs of alkali. Under the common practice of irrigation, however, an excessive amount of water has been applied to the land, thus saturating the soil and subsoil so that now water can be found at a depth of from only 3 to 10 feet beneath the cultivated fields, while many tracts at lower levels have been so frequently flooded that alkali has accumulated, and they have become mere swamps or plains covered with the glistening salt, resembling at a distance fields of snow. The investigations that have been made under the direction of Prof. Whitney show that the ultimate source of this salt is in the underlying shales and other rocks whose decay has furnished the soils. In a humid climate the easily soluble materials are removed, but in an arid region they tend to accumulate. With an excessive application of water to the soil, and the consequent evaporation drawing to the surface the water from beneath, there is left at or near the top of the ground all of the mineral matter which has been in solution, forming in time the snowlike crust. In sandy lands where the water can percolate beneath the surface these alkaline salts do not accumulate as rapidly, while with the extremely compact so-called gumbo soils the accumulation is notably rapid. These latter soils require great care in cultivation to prevent the evil results from ensuing. One of the deplorable conditions is that, although one farmer may be exceedingly careful, his lands may be ruined by the carelessness or neglect of neighbors situated at higher elevations, and from whose farms the excess water may slowly percolate, carrying the load of saline matter in solution. Thus cooperation must be had not only in bringing water to the land, but in preventing injury to the farms already in use. By thorough drainage relief may be had, but there is danger from the other extreme, namely, that these salts, valuable in themselves and injurious only when in excess, may be completely removed and the soil impoverished, resulting in injury to the resources of the country. The problem of proper conservation of the wealth of the soil is shown by such investigations to be comparable to that of the conservation of the woods and waters, and worthy of a large share of public attention.

Deep Waterways.—An appropriation of $90,000, to be immediately available, has been made for completing surveys and inves-

tigations, including the estimates of cost of deep waterways between the Great Lakes and the Atlantic tide waters, as recommended by the report of the first Deep Waterways Commission, transmitted by the President to Congress January 18, 1897. These investigations were begun under the act of June 4, 1897, appropriating $150,000. The commission, composed of three engineers, was appointed by the President July 28, 1897, being the outcome of the recommendations of the former board. Among the operations at present incomplete is a detailed survey of a feeder canal, to be brought from Black River, New York, heading not far from Carthage and winding along the base of the foothills at a distance of from ten to fifteen miles easterly from the shore of Lake Ontario. The route of this canal turning southeasterly crosses into the drainage area of Oneida River and ends on the summit level near Rome, above the headwaters of Mohawk River. On its way the proposed feeder canal crosses or takes in the many small streams flowing easterly into Lake Ontario, the most important of these being Salmon River. This canal is not planned for navigation purposes, but merely to furnish a sufficient supply of water for the upper levels of a deep-water canal from Lake Ontario to the valley of Mohawk River.

Alaskan Exploration.—Plans are being made for continuing exploration in Alaska, under the appropriation of $25,000 which has been made immediately available. Two parties will be sent out, one consisting of Mr. William J. Peters, topographer, and Mr. Alfred H. Brooks, geologist; the other of Mr. Frank C. Schrader, geologist, and Mr. Thomas G. Gerdine, topographer. They intend to go to Skagway and proceed by the new railway crossing the divide to near Lake Bennett, following the usual route to the Yukon. The first party will travel northwesterly along the base of the Mount St. Elias Range to the head waters of the Copper River and of the Tanana, carrying triangulation and connecting with points established last year. It is hoped to be able to make a reconnaissance map of this little-known area. The other party intends to proceed to the north of the Yukon, making portages to the Koyukuk, and maiuly by canoe explore this or other of the principal streams flowing in from the north. The results of the explorations carried on during 1898 are nearly ready for publication in pamphlet form. The descriptive text has been prepared to accompany one large map and eight more detailed sheets, showing the present condition of geographic knowledge of the interior of Alaska.

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MARCH–MAY, 1899.

BY PURCHASE.

The Jesuit Relations and Allied Documents, edited by Reuben Gold Thwaites, Vols. XXXVI–XL, Cleveland, 1899, 8vo; A Vocabulary of Words in the Hawaiian Language, by Lorrin Andrews, Lahainaluna, 1836, 8vo; Views in Rome and its Environs, by Edwin Lear, London, 1841, folio; Tableaux Soudanais, par Edouard Guillaumet, Paris (1898), 12mo; Les Voies de Communication et les Moyens de Transport à Madagascar, par J. Charles-Roux, Paris, 1898, 8vo; Voyage au Pays des Mines d'Or, Le Klondike, par Raymond Auzias-Turenne, Paris, 1899, 16mo; Minerva, K. Trübner und F. Mentz, Achter Jahrgang, Strassburg, 1899, 8vo; A Collection of Hieroglyphs, by F. Ll. Griffith, Sixth Memoir, Archæological Survey of Egypt, London, 1898, 4to; The Hand Gazetteer of India, by J. G. Bartholomew, Westminster, 1898, 8vo; Bradford's History "of Plimoth Plantation," Boston, 1898, 8vo; Report on the Scientific Results of the Voyage of H. M. S. Challenger, Zoology, Vol. I, London, 1880, 4to; The New Africa, by A. Schulz and A. Hammar, London, 1897, 8vo; The Old Rome and the New, by W. J. Stillman, London, 1897, 8vo; Fifty Years' Reminiscences of India, by Colonel Pollok, London, 1896, 8vo; Gleanings in Buddha Fields, by Lafcadio Hearn, London and New York, 1898, 8vo; Round about New Zealand, by E. W. Payton, London, 1888, 8vo; New English Dictionary on Historical Principles, edited by J. A. H. Murray, Vol. III, D and E, Oxford, 1897, 4to; Supplement to the Bibliography of Algeria, from the Earliest Times to 1895, by Sir R. Lambert Playfair, London, 1898, 8vo; History of the New World called America, by Edward John Payne, Vol. II, Oxford, 1899, 8vo; Persia Revisited, by Sir T. E. Gordon, London, 1866, 8vo; In Northern Spain, by Hans Gadow, London, 1897, 8vo; Historical Atlas of the Chinese Empire, by E. L. Oxenham, London, 1898, oblong folio; General Index to the Library Journal, Vols. 1–22, 1876–1897, New York, 1898, 8vo; The Temple of Deir El Bahari, by Edouard Naville, Part III, London (1898), 4to; Transcripts of Original Documents in the English Archives relating to the Early History of the State of New Hampshire, edited by John Scribner Jenness, New York, 1876, 8vo; Travels in Uruguay, etc., by J. H. Murray, London, 1871, 8vo; Froudacity, West Indian Fables by J. A. Froude, by J. J. Thomas, London, 1889, 8vo; Missionary Labours in British Guiana, by J. H. Bernau, London, 1847, 12mo; The Annual Literary Index, 1898, edited by W. I. Fletcher and R. R. Bowker, New York, 1899, 8vo; Das Hochgebirge der Republik Ecuador, I: W. Reiss und A. Stübel, Reisen in Süd-Amerika, Berlin, 1898, 4to; En Sibérie, par Jules Legras, Paris, 1899, 8vo; Greek Lexicon of the Roman and Byzantine Period, by E. A. Sophocles, Boston, 1878, 8vo; British East Africa, or Ibea, by P. L. McDermott, London, 1893, 8vo; Winters Abroad, by R. H. Otter, London, 1882, 8vo; The Highlands of India, by Maj.-Gen. D. J. F. Newall, London, 1882, 8vo; Geographical Pathology, by Andrew Davidson, New York, 1892, 2 vols. 8vo; New China and Old, by Arthur E. Moule, London, 1892, 8vo; Cyprus: its Resources and Capabilities, by E. G. Ravenstein, London, 1878, 8vo; Observations on China and the Chinese, by W. L. G. Smith, New York, 1863, 12mo; Palermo, Christmas to Whitsuntide, by Alice Durand Field, New York, 1886, 8vo; A Naturalist among the

Head-Hunters, by Charles Morris Woodford, London, 1890, 8vo; Dictionary of National Biography, edited by Sydney Lee, Vol. LVIII, London, 1899; The Great Bell of Moscow, by Aug. de Montferrand, s. l., s. a., 4to; Die Preussische Expedition nach Ost-Asien, Berlin, 1864–1873, 4 vols. 8vo; Reis naar het Oostelijk Gedeelte van den Indischen Archipel, in het Jaar 1821, door C. G. C. Reinwardt, Amsterdam, 1858, 8vo; Cuba, Puerto-Rico y Filipinas, D. Waldo Jiménez de la Romera, Barcelona, 1887, 8vo; Flagmente aus dem Orient, von Dr. Jakob Ph. Fallmerayer, Stuttgart u. Tübingen, 1845, 2 vols. 8vo; Die Völker des Kaukasus, von Friedrich Bodenstedt, Berlin, 1855, 2 vols.; My Diary North and South, by W. H. Russell, London, 1863, 2 vols. 8vo; The Chief Periods of European History, by Edward A. Freeman, London, 1886, 8vo; Methods of Historical Study, by Edward A. Freeman, London, 1886, 8vo; An Account of Corsica, by James Boswell, London, 1769, 3rd edition, 8vo; Linguistic and Oriental Essays, by Robert Needham Cust, 3rd Series, London, 1891, 8vo; Recollections of a Three Years' Residence in China, by W. Tyrone Power, London, 1853, 12mo; Ten Years on a Georgia Plantation since the War, by Frances Butler Leigh, London, 1883, 8vo; Atlas van alle de Zee-Havens der Bataafsche Republick, door Dirk De Jong, Te Amsterdam, 1802, 4to; History of British India, by Sir W. W. Hunter, Vol. I, London, 1899, 8vo; Vocabulario de la Lengua Mexicana, por El P. Fr. Alonso de Molina, 1571 (Reprint, J. Platzmann), Leipzig, 1880, 4to; Annual American Catalogue, 1898; The English Catalogue of Books, 1898, New York, 1899, 8vo; Map of China and Surrounding Regions, by E. Bretschneider, St. Petersburg, 1896, and Supplementary Maps, 1898, folio.

GIFTS.

From Dr. E. Deckert, Author:

Cuba (Land und Leute Monographien), Bielefeld und Leipzig, 1899, 8vo.

From the University Museum, Harvard University, Cambridge:

The Peneplain, by W. M. Davis, Cambridge, Mass. (Extract from The American Geologist, April, 1899.) 2 copies.

From Robert T. Hill, Author:

The Mineral Resources of Porto Rico. (Extract from the 20th Annual Report of the U. S. Geological Survey, 1898–99.)

From Jules Leclercq, Author:

Note sur le plus ancien entrepôt de commerce. (Extrait des Bull. de l'Acad roy. de Belgique, 3e Série, t. XXXVII, 2e partie, No 1, pp. 58–64, 1899.)

From Chandler Robbins:

A Guide on Hakone, with Thermal Springs in that Locality (C. J. Tsuchiya, translator), s. l. 1898, 16mo.

From the Royal Geographical Society, London:

Year-Book and Record, 1899.

NOTES AND NEWS.

THE ANNOUNCEMENT, in the circular of the Seventh International Geographical Congress, that according to preceding usage the English, French, German and Italian languages are admitted as languages of the Congress, is made the subject of an interesting paper (signed R. B.) in the *Revista*, No. 16, of the Madrid Geographical Society:

It is declared to be absurd for a Geographical Congress to exclude the Spanish language, the tongue of the nation which discovered and colonized so large a part of the world, and whose records must be consulted for the proper understanding and elucidation of many of the questions submitted to the Congress.

If a knowledge of Spanish were more general among geographers, we should not so often see, as we now do, in works in other languages facts and incidents adduced as new, which have been legible to all men for two or three centuries in Spanish printed books.

In following the established usage of the International Congresses, it has been forgotten that the Spanish language is more widely spread than the French and the Italian (though French is so generally cultivated that it may claim the first place); that there are more nationalities or States of Spanish speech than of the other four taken together; that the territories of these States occupy an area four times as great as that of the German-speaking countries, one-third larger than that of the French language, and twelve times more than the extent of the Italian, counting in the protectorates and spheres of influence of the three; that the total population of the countries speaking Spanish is double that of the Italian territories; and finally that there are more geographical societies of Spanish language than of the Italian.

Reckoning the numbers of those who speak the five languages, the first place belongs to the English, the second to the German, the third to the Spanish, the fourth to the French, and the fifth to the Italian.

There are seventeen independent States of the Spanish language, three of English, one of German (besides two in which German predominates), three of French, and one of Italian. And of these five, Spanish, the tongue of seventeen nations, is the one which cannot be spoken in the International Geographical Congress.

There is no sufficient answer to this argument. At the same time it appears, on examination of the record, that the International Geographical Congress has not been consistent with itself.

The Regulations of the First Congress, held at Antwerp in 1871, of the Second, held in Paris in 1875, and of the Third, held at Venice in 1881, left the speakers free to express themselves in whatever language they preferred. At Paris Baron Richthofen spoke in German, Sir Henry Rawlinson in English, M. de Séménoff in Russian, Commendatore Cesare Correnti in Italian, M. de Hunfalvy in Hungarian, M. Veth in Dutch.

The reports of the later Congresses afford no light on this point. That of Paris, in 1889, is printed throughout in French (except some bibliographic and other notes); in those of Berne (1891) and London (1895), there are papers in English, French, German and Italian, the four languages admitted by the organizers of the Seventh Congress.

It might have been better to admit, *for publication*, none but papers in English, French and German, the three generally accepted languages; but the earlier precedent of recognizing the speaker's right to choose his own tongue ought not to be set aside in an International Congress.

THE ACADEMY of Sciences, Belles Lettres and Arts, of Rouen, offers the following prizes:

1899.—The Bouctot Prize of 500 francs, to the author of the best critical study on the works of Saint-Evremont.

1900.—The Gossier Prize of 700 francs, for the best work of vocal or instrumental music by a composer born or settled in Normandy.

1900.—The La Reinty Prize of 500 francs, to the author of the best work, either manuscript or printed (written in French), or of the best work of art illustrating the political and social history, the commerce, or the natural history of the Antilles, now or formerly in the possession of France.

1900.—The Bouctot Prize of 500 francs, to the author of the best *etude* on the Norman poets of the XVIth century.

1901.—The Bouctot Prize of 500 francs, for a work of painting, sculpture, engraving or architecture by a native or resident of Normandy.

Each manuscript submitted must bear a motto, which must be repeated on a sealed note containing the *name and residence of the author*. The note will not be opened unless the prize is won.

Works submitted must be sent in, *free*, before the 1st of June, to Dr. Coutan or to M. G. A. Prevost, Secretaries of the Academy.

M. J. DE REY-PAILHADE, of Toulouse, has submitted to the Commission appointed by the Chamber of Deputies on the 6th of February the following summary of the attempts made to apply the decimal hour as decreed by the National Convention:

At Toulouse, a member of the municipal administration reported that the clock of the municipality had been corrected to mark the decimal divisions of time; but, either from lack of skill on the part of the workmen employed or for some other reason, the clock went very badly and ceased to run at the end of three months. No date is given, but entries in account books seem to show that the experiment was tried in the first half of the year 1795.

The decree of the Convention (dated the 4 frimaire, an II.) was suspended by the law of the 18 germinal, an III., and the municipality of Toulouse resolved that the clock should be repaired and that the dial should show the decimal divisions as well as the duodecimal.

The Ecole d'horlogerie, in Paris, has in its archives the report on the new horary system, made by the jury appointed by the National Convention.

The documents of the *Almanach National*, for the years II. and III., are expressed in decimal time. It is known, from the memoirs of the English diplomatist Jackson, that in November, 1801, there was a decimal clock at the Tuileries, then occupied by the First Consul.

The Carnavalet museum possesses a magnificent decimal timepiece, and others are preserved at the Conservatoire des Arts et Métiers and at the Ecole d'horlogerie.

A special commission, appointed by the Minister of Public Instruction in 1897, is still engaged in studying the different plans proposed for the application of the decimal system to the measurement of time and of angles.

At Marseilles the new division of time was officially employed for nearly five years. For six o'clock in the evening the Marseilles authorities wrote:

"Seven hours and five tenths,"

while at Toulouse the Mayor used the following expression:

"Seven tenths and ninety two hundredths, which corresponds to seven o'clock in the evening."

There was not yet in existence a precise terminology. Reforms move slowly and it is to be remembered that the metric weights and measures only became obligatory in France on the 1st of January, 1840.

M. de Rey-Pailhade justly remarks that the conditions are very different at the present day, and he is firm in his belief that the decimal division of time will be adopted, by degrees, and without disturbance of the mental habit. This may well be and yet with no no more real advantage to mankind than if stenographic characters took the place of ordinary script.

THE CENTRAL METEOROLOGICAL OBSERVATORY, of Mexico, announces, under the date of April 10, the death of its Director, the distinguished engineer and naturalist, Don Mariano de la Bárcena.

OBITUARY.

SIR GEORGE FERGUSON BOWEN, G.C.M.G.

Sir George Bowen, a Corresponding Member of the American Geographical Society since the year 1892, died on the 21st of February, after a brief illness.

Born in 1821 and educated at Oxford, he began his public life as Secretary to the Government of Corfu. In 1859 he was appointed Governor of Queensland, and he displayed untiring energy in the discharge of his duties and in the exploration of the colony for nine years, succeeding Sir George Grey in 1868 as Governor of New Zealand. He was made Governor of Victoria in 1873, of Mauritius in 1879 and of Hong-Kong in 1883. This last office he held till 1887, and in 1888 he was appointed Royal Commissioner to Malta.

The record of his honourable career is contained in the selections from his official papers, edited, under the title of *Thirty Years of Colonial Government*, by Mr. Stanley Lane-Poole.

TRANSACTIONS OF THE SOCIETY.

MARCH–APRIL, 1899.

A Regular Meeting was held at Chickering Hall on Monday, March 13, at 8:30 o'clock P.M.

Vice-President Tiffany in the chair.

Mr. Robert T. Hill, of the U. S. Geological Survey, was introduced and addressed the Society on the subject of Cuba: Its Resources and People.

On motion, the Society adjourned.

A Regular Meeting was held at Chickering Hall on Monday, April 10, at 8:30 o'clock, P.M.

Vice-President Moore in the chair.

The Chairman made the following announcement:

It is my privilege to inform you that the Society has bought two lots of land, each 25 feet x 102 feet, on the north side of West Eighty-first Street, between Central Park West and Columbus Avenue, and facing the open square on which stands the Museum of Natural History. The situation is readily accessible from all parts of the city.

The Council have thought it not imprudent to buy the lots and begin the construction of a fire-proof building, completing it now only so far as may be necessary to provide offices and working rooms, and to insure the safety of our valuable library. It is not in contemplation to build a lecture hall for the Society's use. Experience has shown that it is advisable to remain free to hold our meetings in some convenient central hall, hired for the purpose.

In response to the circular of February 28, subscriptions amounting to $30,400 have been received. This amount, added to the General Cullum legacy, and to other contributions which the Society has been accumulating, is still not enough to meet the existing need. From the fact that few subscriptions of less than $250 have been received, it is feared that many have the impression that only large contributions are desired. This is an erroneous impression. The Treasurer will be glad to receive subscriptions of any amount from those who may wish to associate themselves with the useful and generous work of providing an adequate home for the Society,

The Chairman then introduced the speaker of the evening, Dr. Clarence H. Young, who gave an account of his Peloponnesian Journeys.

On motion, the Society adjourned.